MULTIPLE JEOPARDIES OF HAITIAN VULNERABILITY: HOW SOCIO-ECONOMIC AND POLITICAL FACTORS EXACERBATE ENVIRONMENTAL HAZARDS IN HAITI

by Crystal Andrea Felima

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ABSTRACT

Environmental hazards reveal geographic, socio-economic, political, and cultural vulnerabilities. While natural hazards are recurring events, their effects are not necessarily natural. The risk of a disaster results from the interaction between human exposure to a natural hazard and the level of vulnerability. Simply, an environmental disaster is normally described as a natural event; however, it should also be characterized as a social phenomenon based on vulnerability and human processes.

This thesis aims to analyze the differential vulnerabilities of Haiti in the face of natural hazards. Haiti, the poorest country in the western hemisphere, is a prime example of a Caribbean country that is vulnerable to hazards. Without a national response system or governmental agencies to prepare for or deal with the aftermath of such environmental hazards, the Haitian population is inadequately prepared for recurring natural hazards such as hurricanes. In addition, Haiti's socio-economic and political instability, coupled with the country's geographic location, heightens the level of disaster risk. These conditions make the island particularly vulnerable to recurring natural hazards.

Historically, Haiti has suffered many deaths and injuries from the effects of environmental hazards, causing higher casualties than its neighboring countries in the Caribbean Basin. This thesis provides three exemplary cases to illustrate the devastating impacts of natural hazards as a result of socio-economic and political factors that exacerbate multiple jeopardies in Haiti. These causal factors produce unfortunate and deadly outcomes for Haiti and the population, and if not addressed, Haiti will continue to suffer.

While natural hazards present socio-economic, political, and environmental challenges in a society, they can be managed with appropriate mitigation measures and preparedness strategies. To yield positive results, development initiatives in Haiti must

also be pursued in order to provide lasting improvements in human safety, economic security, and environmental management. The aim of this thesis is to examine six objectives: (1) deconstruct and reconstruct the term natural disaster; (2) explain why the devastating impacts of environmental disasters in Haiti are not necessarily natural; (3) focus on the Haitian population and development rather than a hazard itself; (4) bridge the conceptual division between disaster and development; (5) evaluate the multiple jeopardies (i.e. dangers) of Haitian vulnerability that contribute to environmental disasters; and (6) propose various strategies and recommendations to promote development and disaster planning. In sum, this thesis intends to explain that environmental disasters in Haiti are not due to only to natural causes; they can be prevented or lessened with proper strategies and policies to reduce vulnerability and disaster risk.

BIOGRAPHICAL SKETCH

Crystal Andrea Felima was born to an African American mother, Brenda Ann Felima, and a Haitian father, Musset Felima, on October 28, 1987 in Miami, Florida. Shortly after the birth of her sister in 1991, Mr. Felima died in a tragic construction work accident. As a result, Crystal and her immediate family moved to the rural town of Calhoun Falls, South Carolina to be closer to her maternal family members.

After graduating with honors at the age of sixteen in 2004, Crystal enrolled in her state's flagship university to earn a B.A. degree in African American Studies and a minor in Political Science. As a student at the University of South Carolina, Crystal was actively involved on campus. Among her activities, Crystal became a member of Delta Sigma Theta Sorority, Inc., served as President of SAVVY (a multi- cultural women's organization), volunteered as a tutor for the Upward Bound Program, and participated in the Minority Assistance Peer Program as a peer mentor.

Crystal's scholarship in Haitian Studies started outside of her work at her undergraduate institution. In 2007, she applied to and was selected for participation in a competitive 9-week summer hurricane research program at the University of South Florida in Tampa, Florida, fully funded by the National Science Foundation. Under the direction of Professor Beverly Ward of the University of South Florida's Anthropology Department, she created a project to build upon her long standing interest in the African Diaspora and to connect more deeply with her father's country of Haiti. Her project was entitled "Haiti's Disproportionate Casualties after Environmental Hazards." The principal themes of this research concerned issues of risk, development, vulnerability, poverty, and human systems. Her essay was printed in the January 2009 issue of the *Journal of Haitian Studies*.

After completing her undergraduate degree in 2008, Crystal enrolled in the Africana Studies Masters program at Cornell University to continue her work in

Haitian Studies. Her research experiences and educational background at Cornell University uniquely underscore her commitment to Haitian scholarship. She earned several travel grants to conferences and a research travel grant to conduct fieldwork in Haiti for her thesis. Through community service, Crystal created a mini-course titled "The Haitian Experience: History, Culture, and Society," in which she taught young men of color, ages 13-17, at an alternative school in Lansing, New York. Among her organizational memberships, Crystal was elected as a student member on the Board of the Haitian Studies Association—she has presented two papers at their sponsored conferences. Crystal was also involved in the Cornell's Haitian Students Association. In addition, she has participated as a panelist at a discussion titled "Haiti and the Current Crisis", sponsored by her department. Crystal's commitment toward Haitian scholarship and service was honored with the 2008 Certificate for Service to Haiti by the Florida International Volunteer Corps, a program directed under the Florida Association for Volunteer Action in the Caribbean and the Americas, Inc. (FAVACA).

Although being accepted into a PhD program in Anthropology, Crystal decided to defer her admission for a year. Crystal was offered a teaching position at a new charter school in the rural town of Blytheville, Arkansas. As a founding teacher at KIPP Blytheville College Preparatory School, Crystal will teach 5th grade. She is excited about *teaching the babies.*

We could re-define and re-claim our history, our culture, and our image.

However, we should not forget our people regardless of the costs involved.

-Crystal Andrea Felima

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Last but not least, Haiti for inspiring me to be the higher me.

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LIST OF ABBREVIATIONS

ADMD	Dominican Disaster Mitigation Association
CIA	Central Intelligence Agency
CNSA	Coordination Nationale de la Sécurité Alimentaire
DHS	Demographic Health Survey
EDH	Electrite d'Haiti
EM-DAT	Emergency Events Database
FRD	Federal Research Division
GIS	Geographic Information System
HDI	Human Development Index
IDL	International Date Line
IFRC-CRCS	International Federation of Red Cross and Red Crescent Societies
IOM	International Organization for Migration
MPWTC	Ministry for Public Works, Transportation and Communications
MINUSTAH	United Nations Stabilization Mission in Haiti
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
OCHA	Office for the Coordination of Humanitarian Affairs
SIDS	Small Island Developing States
TVNI	The Vetiver Network International
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction
USGS	United States Geological Survey
WINNER	Watershed Initiative for National Natural Environment Resources

WFP	World Food Programme
WHO	World Health Organization

INTRODUCTION:

Haiti's Current Challenges

Piti, piti, wazo fe nich li.
Little by little, the bird builds its nest.

-Haitian Proverb

Environmental hazards cause extensive loss and disruptions to populations and their development. The impacts of environmental events reveal geographic, socio-economic, political, and cultural vulnerabilities. While natural hazards are recurring events, their effects are not necessarily natural. The risk of a disaster results from the interaction between human exposure to a natural hazard and the level of vulnerability. Simply, an environmental disaster is normally described as a natural event; however, it should also be characterized as a social phenomenon based on vulnerability and human processes.

While natural hazards present socio-economic, political, and environmental challenges in society, they can be managed with scientific and technological advances aimed to identify risk and to reduce natural hazard exposure to humans and property. Appropriate mitigation measures and preparedness strategies such as warning and evacuation systems can reduce the impacts of environmental disasters. While disaster management can yield positive results, development initiatives must also be pursued in order to provide lasting improvements in human safety, economic security, and environmental management.

The scientific and technical community can create and implement disaster preventive measures for vulnerable populations. In addition, national governments and the international community can provide vulnerability reduction in the form of

effective policies and development initiatives. This can significantly enhance standards of living, while promoting natural hazard management.

A disaster may be regarded as the manifestation of an unforeseen and sudden event with catastrophic and unpredictable consequences. Development—an imprecise concept—includes the protection of all aspects of human growth and well-being, the capacity to secure livelihoods and resources, and the ability to maintain a comfortable level of standard of living. Cardona (2004) asserted that "disasters should be understood as unsolved development problems since they are not events of nature *per se* but situations that are the product of the relationship between the natural and organizational structure of society" (p. 50). In relation to understanding the crises in Haiti, disaster and development have been situated as a dichotomy—separated into two mutually exclusive groups as if they do not influence on each other. Since the 1970s and 1980s, scholars and scientists revisited the traditional understanding of *natural disasters* and vulnerability. With new understanding, these scholars found that it is the environmental hazard (e.g., earthquake, flooding, and hurricane) that is natural; however, the impacts and risks associated with them are not. These impacts may be directly connected to the level of development within a society. Therefore, disasters and development do not necessarily contradict each other nor need be at the opposite poles of research studies and humanitarian discourse. This thesis aims to link Haitian environmental disasters to the country's development as a means to contribute to the established conceptual framework of understanding *natural disasters* and vulnerability in relation to at-risk populations. For Haiti, disaster and development must be considered mutually in order to analyze the many crises at hand.

In light of the growing work in disaster-development studies, I aim to provide my modest contributions to the field. This thesis aims to coalesce the conceptual division between two categories, disasters and development, by using Haiti as an

exemplar case. In general, the islands of the Caribbean region are exposed to a number of extreme environmental hazards including hurricanes, earthquakes, and volcanoes. However, specifically for Haiti, a number of natural hazards (e.g., hurricanes and flooding) have resulted in environmental disasters and economic vulnerability. The country's most recent tragedy resulted from a 7.0 magnitude earthquake on January 12, 2010. This disaster crippled Haiti's development and has placed additional constraints on sustainability. Therefore, effective and sustainable development must be pursued in order to challenge Haiti's fragility as a developing, vulnerable state.

As proposed, Haiti serves as an exemplar case to improving our understanding of the link between disasters and development. For this thesis, it is my intention to bridge development and ecological issues to focus specifically on socio-political and economic factors that support or neglect Haitian development before, during, and after an extreme natural hazard event. I want to examine the link between Haiti's environment and society considering that the development of a society is critically dependent on the development of its environment and vice versa. Therefore, I intend to consider several critical research questions: *How have Haitians shaped the environment over time, and how has the environment shaped Haitian development? What support is needed and what strategies are feasible for development in Haiti? How can existing aid and development projects be restructured to tackle Haiti's fragile environment and growing population? How can community engagement and participation empower Haitian communities? How is Haiti positioned in human rights and development discourse? What is being said? What support is being offered?*

The urgency of these questions brings many scholars—as well as national officials, foreign agencies, and humanitarians—to pursue research on disasters and development in Haiti. As a means to answer these questions, my methodology includes theoretical research with textual analysis. I utilized various literatures

including academic journals and publications, graduate theses, reported statistics and data, documents from disaster relief agencies, and news articles and reports. This serves as the basis of my analysis. I examined various theories and concepts within environmental, sociological, and anthropological studies in order to analyze the socio-economic and political factors that contribute to Haiti's high level of vulnerability. In addition, I traveled to Haiti to informally discuss my research with people in the country. My discussions were guided by a pre-defined list of open-ended questions and broad issues. These discussions were used to reinforce and complement my research and to generate new ideas for future research projects. Due to time limitations, I used these conversations to merely inform me about my project; therefore, I did not record any remarks and personal information. In mapping my research trajectories, I aim to produce a comprehensive and comparative study which takes an interdisciplinary approach to provide a holistic understanding of the realities, possibilities, and limitations of the Haitian experience and future prospects.

Research in this thesis reflects disaster work, population studies, environmental management themes, and recommendations already presented in my earlier work entitled "Haiti's Disproportionate Casualties after Environmental Disasters: Analyzing Human Vulnerabilities and the Impacts of Natural Hazards", published in the *Journal of Haitian Studies*, Volume 15 (2009). This article serves as a basis for my thesis. As the title suggests, this essay examined why Haiti's casualties disproportionately outnumber other neighboring countries in the Caribbean after major hurricane events. It is my intention in this thesis to revisit and re-examine Haitian vulnerability, and to provide an in-depth understanding of the challenges towards sustainable development.

Chapter One, "Environmental Disasters and Vulnerability," aims to examine and broaden the understanding of *natural disasters*. Previous understanding of this term has not fully captured the realities of vulnerable populations in disaster risk areas.

Therefore, this chapter intends to interrogate the traditional understanding of natural disasters by offering a broader perspective that integrates and anchors new approaches of how environmental hazards impact various regions and populations. The first section introduces and outlines the topics within Chapter One. The second section highlights four natural hazards that are particularly recurrent in the Caribbean region. The third section, "Environmental Disasters", will highlight and address natural hazards and their impacts within a global and regional context. The fourth section, "Vulnerability" will focus on risk and the susceptibility of human populations to hazards.

Chapter Two entitled "Haiti: A Disaster-Prone Built Environment" is meant to link the development of the country and environmental disasters in order to provide a holistic, in-depth investigation of the situation in Haiti. The phrase "built environment" refers to the surroundings—both man-made physical structures and the natural environment—that have been shaped and created by human activities over time. Three selected case studies are highlighted to exemplify the effects of environmental hazards (specifically flooding and hurricanes) in vulnerable areas of Haiti. These case studies provide the background information for the socio-economic and political implications underlined in the third chapter.

Environmental disasters can afford Haiti a critical opportunity for successful crisis mitigation and socio-economic transformation through reconstruction and rebuilding. In Chapter Three, "Haitian Vulnerabilities: Primary Causal Factors and Solutions," two fundamental questions regarding Haiti's environmental and disaster crises will be addressed: What are the casual factors? What are some solutions? The first section, "Haitian Jeopardies", stresses the underlying conditions—socio-economic, political, environmental, and institutional—of Haitian vulnerability to the impacts of natural hazards. The second section, "Solutions and Recommendations"

proposes various plans and strategies intended to promote development and a healthy environment.

This thesis is built upon the principal themes of vulnerability, disaster risk, and development in order to provide an interconnected framework of social scientific studies. It aims to analyze the differential vulnerabilities and resiliency of Haiti in the face of a natural hazard. As already mentioned, my approach takes an interdisciplinary view designed with a specific intent of contributing to understanding the multiple jeopardies (i.e. dangers) of the Haitian population. Understanding the missing link between disaster and development in Haiti must be furthered. With this view, my study looks to advance the current research regarding Haiti's current challenges of environmental degradation, low development, and political and socio-economic instability.

CHAPTER 1:

Environmental Disasters and Human Vulnerability

Malè avèti pa touye kokobe.
A foreseen disaster does not kill the handicapped.

-Haitian Proverb

1.1. INTRODUCTION

Over the past decades, environmental hazards have greatly impacted and disrupted populations worldwide. The great majority of disaster-induced deaths occur in highly populated and/or low or medium human development countries, particularly within Latin America and the Caribbean, Asia, and Africa. For Latin America and the Caribbean, many nations are threatened by a significant loss of life, catastrophic property damage, and disruption to livelihoods and development caused by environmental hazards. Environmental disasters resulted in 180,000 casualties and US $54 billion in damages from 1960 to 1990 in these regions (Berke and Beatley, 1997:1).

Table 1: Comparison by Region of Death Toll from Disasters[1]

Region	*Deaths per Million*
North American	31.50
Europe	38.57
Central America/Caribbean	918.16
South America	341.33
Asia	376.28
Africa (excluding droughts)	117.05
Australia/Oceania	323.50

Source: Rosenfeld, et al. (2005:133).

[1] This table is found in Rosenfeld, et al. (2005); however, the data information is originally from Stephen A. Thompson's "Trends and Developments in Global Natural Disasters, 1947-1981"—NHRAIC Working Paper 45, University of Colorado (August 1982).

Nations worldwide—particularly developing nations—are continuously confronted with multiple environmental stresses ranging from the depletion of natural resources to severe desertification. Factors including population growth, poverty, and inequitable land rights have created a high level of vulnerability for many regions. These factors contribute to human-induced disasters that plague societies and pose great threat to their economic and social development.

Human pressures on the natural environmental have created an opportunity for disasters. These pressures have disrupted and disabled nature's ability to provide healthy and resilient ecosystems for populations. By way of examples, wetland ecosystems function as natural sponges that trap and slowly release surface water, and mangroves create physical barriers between communities and coastal hazards. However, factors such as human interference, environmental degradation, social inequalities, and population growth have increased the likelihood of destruction to our ecosystems. Healthy ecosystems can save lives and protect livelihoods.

Environmental hazards create several disaster risks for many populations, including economic, social, and environmental impacts. These impacts underscore the multiple socio-economic and political contexts and reflect the human systems in which disasters occur. To that end, environmental hazards are recurring routine natural events. However, the social-economic, political, and environmental impacts are not necessarily natural.

Economic impacts are experienced through property damage and assets losses, which can result during and after a natural hazard event. Populations can experience economic losses to their shelter, vehicles, and other physical property. Individuals can also experience loss in financial resources and employment. Societies are impacted through their physical infrastructures and welfare systems including schools, transportation and communication lines, sewage and sanitation systems, and medical

facilities. In addition, the business and market sector can experience loss to buildings, machinery, and production capital. These impacts from environmental hazards can cripple a society's development and economic growth, pressuring governments to re-allocate financial resources to support affected populations.

In addition, the social impacts from environmental disasters can impact populations' livelihood and social well-being. Disasters can result in the loss of life, physical injuries, emotional trauma, displaced persons (in terms of loss of employment and forced migration), and damage to cultural possessions and heritage sites. Other social impacts may include an increase in diseases and illnesses, disruption to student attendance in school, increase in stress, depression, and emotional distress, and disruption to social contacts and relationships.

Environmental impacts include disruption to nature's natural defenses to protect animals and human populations, and to prevent devastation to water and agricultural resources. Irrigation systems and soil can be disrupted and degraded causing devastation to water consumption and agricultural production. Environmental impacts can also disrupt livelihood security in the form of employment in agriculture, forestry, and fishing. Additionally, natural hazards such as tropical storms can cause heavy rains to inundate rivers and cause storm surges along coastlines—making populations extremely vulnerable to disastrous impacts.

To conclude, two critical topics (environmental hazards and vulnerability) are discussed within this chapter in order to provide a general understanding of extreme natural events, environmental disasters, and human vulnerability. Each section includes coverage of issues aimed to conceptualize, identify, and theorize vulnerability through a multi-disciplinary lens. To preface this thesis, four major environmental hazards are discussed: tropical cyclone, flood, drought, and earthquake. These environmental hazards are particularly recurrent in the Caribbean region.

1.2. NATURAL HAZARDS

Hydro-meteorological and geophysical disasters[2] have greatly impacted populations worldwide. According to the United Nations Development Programme (UNDP) Global Report (2004), approximately 75 percent of the world's population lives in areas affected at least once by an earthquake, tropical cyclone, flood, or drought between 1980 and 2000. In addition, billions of people in more than 100 countries are periodically exposed to these environmental hazards. As a result, more than 184 deaths per day are recorded throughout the world due to disasters caused by these four natural hazards (p. 1).

1.2.1. *Tropical Cyclone*

The UNDP (2004) noted that approximately 119 million people are found to be exposed on average every year to tropical cyclones, and some people experience an average of more than four events every year. A total of 251,384 casualties resulted from tropical cyclones worldwide from 1980 to 2000. Sixty percent of reported deaths were in Bangladesh, and the Philippines shows the highest frequency of tropical cyclones with reported deaths. Nations with high vulnerability to these cyclones include Bangladesh, Honduras, Nicaragua, India, Philippines, Vietnam and Small Island Developing States (SIDS) such as Haiti (p. 3, 36-37). Within SIDS, Haiti is shown to have the highest relative vulnerability to tropical storms from 1980-2000. The UNDP proposed that this is linked to Haiti's "small economy, degraded environment and weak institutions of governance" (p. 39). The UNDP offered a comparison between Haiti and two SIDS, Cuba and Mauritius. While these islands experience tropical cyclones due to their geographic locations, Cuba's and Mauritius' political system, level of development, and disaster preparedness strategies offer a

[2] Hyrdo-meterological disasters include droughts, extreme temperatures events, floods, and storms. Geophysical disasters include earthquakes, slides, volcanoes, and storm surges. Other disasters include—but are not limited to—famine, insect infestations, wildfires, and epidemics.

lower level of vulnerability. This provides positive results before, during, and after a tropical cyclone event.

A tropical cyclone is a low-pressure storm system accompanied by powerful thunderstorms that produce strong winds and heavy rains. These storms are maintained by heat energy. The term "tropical" refers to the geographic origin of these systems, which develop over tropical or subtropical waters. The term "cyclone" refers to the storms' cyclonic nature, with an atmospheric closed circulation rotating counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Depending on location and intensity, tropical cyclones are referred to by various names: hurricanes in the North Atlantic Ocean, the Northeast Pacific Ocean east of the International Date Line (IDL)[3], or the South Pacific Ocean east of 160° E; typhoons in the Northwest Pacific Ocean west of the International Date Line; tropical cyclones in the Southwest Indian Ocean; severe tropical cyclones in the Southwest Pacific Ocean west of 160° E or Southeast Indian Ocean east of 90° E; and severe cyclonic storms in the North Indian Ocean. Tropical storms are classified by the average speed of the wind near the storm's center:

Wind Speed	Classification
Up to 39 mph	Tropical Depression
39 mph to 73 mph	Tropical Storm
Greater than 73 mph	Hurricane

[3] The IDL is an imaginary line that sits on the 180º line of longitude in the middle of the Pacific Ocean and it separates two consecutive calendar days. This means that the date in the Eastern hemisphere (to the left of the line) is always a day ahead of the date in the Western hemisphere. The IDL has been moved slightly over the years in order to accommodate the needs of countries in the Pacific Ocean.

As shown immediately above, the stages of development for a hurricane begins with a tropical depression, which develops into a tropical storm and intensifies into a hurricane. The intensity of a hurricane is measured and categorized by the Saffir-Simpson Scale based on the hurricanes wind speed and potential damage. The scale, developed in 1969 by American engineer Herbert S. Saffir and meteorologist Robert H. Simpson, ranges from 1 to 5, with 5 being the most severe and damaging. It is used officially to classify tropical cyclones formed in the Atlantic Ocean and northern Pacific Ocean east of the International Date Line. The Saffir-Simpson Hurricane Wind Scale is as follows:

Hurricane Category	Wind Speed	Damage
Category 1	Winds 74-95 mph	Minimal
Category 2	Winds 96-110 mph	Moderate
Category 3	Winds 111-130 mph	Extensive
Category 4	Winds 131-155 mph	Extreme
Category 4	Winds over 155 mph	Catastrophic

The destructive potential of a storm is due to high winds accompanied by torrential rains, which can produce flooding, soil erosion, landslides, and storm surges. A storm surge is an abnormal rise in sea level associated with a hurricane or other intense storm. Flooding from a storm surge can extend 100 miles wide of a coastline and several miles inland. Noted by Barnes (2005), many coastal areas are densely populated and lie only a feet or meters above sea level. Approximately 37 percent of the world's population lives within 62 miles (100 kilometers) of a coastline (Abramovitz, 2001:23). This can be very dangerous to such populations due to their

geographic location. To conclude, tropical storms can cause extensive and multiple damages to the environment, economy, and social welfare system.

1.2.2. *Flood*

An estimated average of 196 million people in more than 90 countries is exposed every year to flooding. Countries with high vulnerability to floods include Somalia, Morocco, and Yemen. From 1980 to 2000, roughly 170,010 deaths resulted from floods (UNDP, 2004:3, 40).

Temporary water runoff causes flooding. Floods can result from a short duration of high intensity force or a long duration of low to moderate intensity. Flooding can be characterized by two types: (1) land-borne floods or river flooding—if there is runoff in a lake or river, excess water may overflow or break levees, causing water to escape rivers/lakes' normal boundaries; and (2) sea-borne floods or coastal flooding—caused by storm surges.

In sum, flooding becomes a significant problem when the amount of water saturates and inundates the land, endangering populations and property. Flooding has been associated with heavy rains from the effects of tropical storms, dam failure or levee breeches, flash flooding, and snowmelts. Populations located in dense areas, along coastlines, and/or in urban areas are particularly prone to flooding.

1.2.3. *Earthquake*

The UNDP (2004) reported a yearly average of 130 million people is at risk to earthquakes. From 1980 to 2000, a total of 158,551 deaths resulted from earthquakes, with Iran having the highest toll of casualties at 47,267 deaths. Vulnerable countries included Iran, Afghanistan, India, Turkey, Russia, Armenia, and Guinea (p. 3, 36).

An earthquake is a sudden vibration of the Earth, generally produced by the abrupt displacement of rock masses beneath the Earth's surface[4]. Plate tectonics is the continuous slow movement of the Earth's outer crust. Rock masses under the Earth's surface pass each other constantly; however, when the plates get into a "traffic jam", they lock together restricting the plates' movement. From this, energy is accumulated. The plates eventually break free, causing a sudden release of energy that creates seismic waves. This causes the ground to shake (i.e., an earthquake).

According to the United States Geological Survey (USGS), several million earthquakes occur in the world yearly; however, many quakes go undetected since they take place in remote, uninhabited areas or have extremely low magnitudes. The Richter scale, created by American seismologist and physicist Dr. Charles Richter in 1935, is widely used to measure an earthquake's magnitude. This scale quantifies the size of an earthquake by using a base-10 logarithmic scale. That is, a 4.0 magnitude earthquake is 10 times larger than a 3.0 magnitude earthquake. Due to scientific and technological advances, the moment magnitude scale was introduced in 1979 by seismologists Tom Hanks and Hiroo Kanamori. This scale is universally used to measure earthquakes; however, the information and values are comparable to the Richter's scale. The Mercalli Intensity Scale is also used, rating earthquakes' intensity by Roman numerals from I to XII. The scale quantifies the impacts of an earthquake on the Earth's surface, human populations, physical property, and the environment.

Earthquakes cause ground shaking, differential ground settlement, soil liquefaction, landslides or mudslides, permanent ground displacement along fault lines, avalanches, fires, and/or floods from destructive ocean waves (i.e., tsunamis). The impacts of an earthquake include extensive injuries and deaths—specifically in a

[4] Earthquakes can be caused by volcanic eruptions, landslides, meteor impacts, underground explosions (e.g., underground nuclear test), and/or collapsing structures (e.g., collapsing mine).

heavy populated area, damages to physical property, transportation systems, and social welfare institutions, and failure to communication networks. Noted by the UNDP (2004), nations with high urban growth rates and high physical exposure are particularly at risk of earthquake incidences (p. 3).

1.2.4. *Drought*

Roughly 220 million people are exposed to drought every year, with African nations having the highest vulnerability. From 1980-2000, a total of 832,544 deaths resulted from droughts worldwide. Research noted that Mozambique and Ethiopia experienced the highest level of vulnerability to droughts (UNDP, 2004:3, 47).

Drought is an extended, abnormal period of moisture deficiency, which causes multiple problems to a society and the environment. While flooding is simply too much water, drought is not having enough. Human activities and pressures (e.g., deforestation, over farming, and excessive irrigation) can also cause water shortages in areas.

Drought can be defined in several ways. Meteorological drought is based on the degree and duration of dryness in an area that is abnormal. Agricultural drought occurs when the lack of water moisture no longer meets the needs for crop production and agricultural needs. Hydrological drought impacts the surface and subsurface water supplies (e.g., stream flow, reservoir and lake levels, and ground water) causing potential significant societal impacts, which may not meet human and environmental needs. Water is an integral part of daily life. Therefore, drought can cause many economic, social, and/or environmental impacts to water intensive activities including agriculture, wildfire protection and preservation, population usage, commerce, tourism, and recreation.

1.3. ENVIRONMENTAL DISASTERS

This section highlights and addresses natural hazards and their impacts within a world and regional context. In addition, two disaster-related outcomes—mortality and economic losses—are used to classify and categorize the severity of disasters and their impacts on human populations. This section aims to show that disasters disrupt the social fabric of all regions. However, particularly in highly populated and/or developing nations, social institutions are disrupted, livelihoods are disturbed, and development is crippled. Environmental disasters can "discriminate" as they restrict vulnerable countries from restoring their economic resources and recovering from all impacts after a crisis period due to their lack of financial resources and disaster mitigation and preparedness strategies.

1.3.1. *World Context*

Nations have been devastated by a number of environmental disasters, which have caused damage amounting to billions of dollars and thousands of deaths. Developing countries are most adversely affected by disasters. According to the International Federation of Red Cross and Red Crescent Societies (IFR-CRCS) (2001), quoted in Rosenfeld, et al. (2005), a yearly average of 211 million people were killed or affected by environmental disasters from 1991 to 2000 (p. 131). Noted by the United Nations International Strategy for Disaster Reduction (UNISDR) (2009), the Emergency Disasters Database (EMDAT) recorded 8,866 environmental events—excluding epidemics—which caused 2,283,767 casualties and US$ 1,527.6 billion in economic losses between 1975 and 2008. Of these natural hazard events, 23 mega-disasters killed 1,786,084 people, mainly in developing countries (p. 3-4). From 1975 to 2002, floods, earthquakes, and windstorms were at the forefront of devastation, causing over 90 percent of damages worldwide (Arakida, 2006:292-293).

According to Munich Re, as noted by the UNDP (2004), annual economic losses from environmental disasters averaged US$ 75.5 billion in the 1960s, US$ 138.4 billion in the 1970s, US$ 213.9 billion in the 1980s, and US$ 659.9 billion in the 1990s. These losses are primarily concentrated in highly populated nations or/and in developed countries that are industrialized and "modernized" due to technological advances. For example, during 1985-99, the global economic losses from disasters resulted in US $918.7 billion. Of this figure, Asia represents 45 percent of these losses, following by North America with 33 percent, Europe at 12 percent, the Caribbean at 3 percent, Central America at 2 percent, South America at 2 percent, and Africa at 1 percent (Abramovitz, 2001:13). Developed countries may have little to no impact in terms of deaths from natural hazard events due to their disaster preparedness measures, quality of insurance, and control over livelihoods. These figures do not reflect the impact of environmental hazards on developing countries that experience high, disproportionate casualties. The UNDP (2004) has furthered mentions that 85 percent of people exposed to natural hazards live in low or medium human development countries.

Development directly influences how a natural hazard will impact a population—the degree of damages could be minimal to severe. A natural hazard can impact thousands to millions of individuals and disrupt the social fabric of a society; however, these effects can be specifically devastating for highly populated areas and/or developing countries. According to the IFC-CRCS (2001), noted by Rosenfeld, et al. (2005), approximately 92 percent of casualties caused by environmental hazards (excluding droughts) occurred in Asia, Africa, and Latin America between 1947 and 1981. In regards to developing nations, between 1991 and 2000, 98 percent of casualties and injuries caused by a natural hazard event occurred in low or medium human development countries (p. 133). Additionally, on average 22.5 people die per

reported disaster in highly developed countries, 145 people in medium human development countries, and 1,052 people in low human development countries (Rosenfeld, et al.). While only 11 percent of people exposed to natural hazards live in low human development countries, these nations account for more than 53 percent of total recorded deaths (UNDP, 2004:1). High human development countries represent 15 percent of the exposed population and only 1.8 percent of the deaths (p. 3). These figures provide an alarming comparison between the varying degrees of vulnerability and levels of development. As stated by the UNDP (2004), "…disaster risk is intimately connected to processes of human development. Disasters put development at risk" (p. 1).

Each year, the Caribbean region is threatened by significant loss of life, catastrophic property damage, and disruption to livelihoods and development by environmental hazards. Table 1 illustrated a clear indication of the severity of natural hazards in the Caribbean region. The social impacts of environmental hazards occur in different contexts for various nations. A tropical storm in one country may cause severe devastation, in terms of death. However, the same tropical storm—with comparable or higher intensity—may cause little to moderate losses in another country. This correlates to the level of development, population density, disaster risk, and vulnerability—not simply based on the *naturalness* of disasters.

Developing nations are less able to invest in disaster preparedness and mitigation strategies. Losses from environmental hazards in these vulnerable countries are more substantial than developed countries. Resources are crippled and diverted from human and social development programs and projects. This is critical since an environmental hazard can restrict developing nations' capacity to recover back to the pre-disaster period. As stated, the majority of disaster-induced deaths occur in Asia, Africa, and Latin America and the Caribbean. This reflects how vulnerability and

disaster risk are distributed among and within highly populated and/or developing nations.

1.3.2. *Regional Context: The Caribbean*

Home to over 40 million people, the Caribbean region [defined here as referring to the islands of the Caribbean] is socially and economically vulnerable to environmental hazards due to its size, location, and climatic changes. The Caribbean—located southeast of the Gulf of Mexico and North America, east of Central America, and north of South America—includes numerous islands and surrounding coasts with a total land area of 91,000 square miles, approximately the size of the United Kingdom. The region is commonly referred to as the West Indies due to Christopher Columbus' assumption that he had reached the Indies of Asia upon his expedition in 1492.

Figure 1: Map of the Caribbean
Source: Photo Courtesy of CIA World Factbook Online (2010).

The Caribbean region is spread over more than 2,000 miles of sea. It can be divided into two groups. The first group is the Antilles, which is divided into the Greater Antilles and Lesser Antilles. The Greater Antilles includes the islands of Cuba, Hispaniola (comprising Haiti and the Dominican Republic), Puerto Rico, and Jamaica. These islands comprise over 80 percent of the land area and 90 percent of Caribbean population (Boulet, 2010: 202). The Lesser Antilles includes a chain of islands: the Leeward Islands, the Windward Islands, and the Netherlands Antilles. The second group is the Bahamas, which consist of more than 700 islands, most being low-lying, limestone, dry, and uninhabited (p. 201).

Many Caribbean islands continuously struggle with critical issues linked to sustainable development and economic vulnerability on a daily basis. "Traditional" features of some low-income, developing Caribbean nations include poor and overcrowded housing, sub-standard living conditions, high unemployment and underemployment rates, inadequate and inappropriate sanitation and garbage disposal systems, lack of social welfare and health care institutions, and/or disproportionate resource distribution among socio-economic classes. In addition, some islands face political instability and violence, with Haiti as a prominent example. These major socio-economic challenges cripple development and heighten the level of disaster vulnerability for human populations.

In addition to major socio-economic and institutional stresses, one key issue facing some Caribbean islands is how to promote and to achieve a balanced, healthy ecosystem. Environmental disasters are becoming more severe due to population growth, poor development, and human pressures and practices. Current planning and policy practices result in the conversion of land from its natural state to other uses. The changes in land use (e.g., transportation infrastructure, agriculture, housing, and industrial development) have had a dramatic impact on forest ecosystems in the

Table 2: Caribbean Population Growth Characteristics

Selected Countries	Population	Population Growth Rate	Birth Rate[5]	Death Rate[6]
Antigua and Barbuda	85,632	1.303%	16.59	5.94
The Bahamas	307,552	0.925%	16.41	7.16
Cuba	11,451,652	0.233%	11.13	7.24
Dominican Republic	9,650,054	1.489%	22.39	5.28
Grenada	90,739	0.468%	21.32	6.09
Haiti	9,035,536	1.838%	29.1	8.65
Jamaica	2,825,928	0.755%	19.68	6.43
Netherlands Antilles	227,049	0.732%	14.19	6.48
Puerto Rico	3,966,213	0.298 %	11.72	7.78
Trinidad and Tobago	1,229,953	-0.102 %	14.36	8.11

Source: Created by Crystal Andrea Felima with data from Country Profiles from CIA World Factbook Online (2010).

Table 3: Caribbean Population Measures of Well-Being

Selected Countries	Infant Mortality Rate[7]	Fertility Rate[8]	Life Expectancy at Birth	HIV/ AIDS[9]
Antigua and Barbuda	16.25	2.07	74.76 years	N/A
The Bahamas	14.84	2	69.92 years	3%
Cuba	5.82	1.61	77.45 years	>0.1%
Dominican Republic	25.96	2.76	73.70 years	1.1%
Grenada	13.23	2.23	65.95 years	N/A
Haiti	59.69	3.81	60.78 years	2.2%
Jamaica	15.22	2.25	73.53 years	1.6%
Netherlands Antilles	9.09	1.97	76.65 years	N/A
Puerto Rico	8.28	1.65	78.52	N/A
Trinidad and Tobago	29.93	1.72	70.86	1.5%

Source: Created by Crystal Andrea Felima with data from Country Profiles from CIA World Factbook Online (2010).

[5] Births per 1,000 population
[6] Deaths per 1,000 population
[7] Deaths per 1,000 live births
[8] Children born per woman
[9] Adult Prevalence Rate

Caribbean. As a result, deforestation has become pervasive. Noted by Hillstrom and Hillstrom (2004), approximately 11 percent of the original vegetation cover remains in the Caribbean (p. 44). Human actions (e.g., forest clearance, soil erosion, intensive land cultivation, and over-grazing) have threatened and degraded Caribbean ecosystems, making them no longer resilient and able to cope with environmental occurrences. This has contributed to the varying degrees of environmental degradation in the Caribbean environments.

Table 4: Disaster events for the Countries of the Caribbean from 1900-1997

Caribbean Countries	1900-1997 Events	1900-1997 Death Totals	Total Affected	1997 Total Population
Antigua and Barbuda	7	8	6500	100,000
Bahamas	13	45	0	300,000
Barbados	7	60	0	300,000
Cuba	47	5,079	200,366	10,900,000
Dominica	11	2,061	300	100,000
Dominican Republic	28	4,127	122,770	7,700,000
Grenada	4	6	0	100,000
Haiti	47	13,372	341,711	7,000,000
Jamaica	44	2,354	108,217	2,400,000
St. Kitts/Nevis	7	1	180	45,000
St. Lucia	12	64	78	100,000
Nether. Antilles	3	1	4,000	207,333
St. Vincent	11	1,694	100	100,000
Trinidad and Tobago	11	46	20	1,300,000
US Virgin Isles	1	8	0	97,120

Source: Adapted from Pelling and Uitto (2001:51).

The Caribbean's fragile landscape comprises of high energy climatic environments, with seasonal tropical storm activity and frequent rainfall events (Barker and McGregor, 1995:5). These islands are prone to natural hazards due to their geographic location. Tropical storms form off the northern coast of Africa,

sweeping over the Atlantic Ocean to the Caribbean where warm sea surface temperatures generate cyclonic activity to form tropical cyclones. In addition, some islands are geographically located in active fault zones and on colliding tectonic plates (Boulet, 2010:205). These geographic locations are coupled with some islands' comparatively low level of development (e.g., Haiti), which considerably generates a high degree of disaster risk

Poor infrastructure, political and socio-economic systems, and the lack of warning systems affect the level of resiliency. Population growth also has an impact on settlement patterns, the depletion of natural resources, and migration pressures on land. Countries that are growing at a rapid rate challenge the creation and implementation of essential planning and building regulations. Building and reconstruction without the necessary planning and safety precautions increases the vulnerability to and the risk of adverse impacts resulting from an environmental hazard.

Figure 2: Map of Haiti
Source: Photo Courtesy of CIA GOV (2010).

The key to recognizing environmental pressure points in the Caribbean is to understand the equation between the islands' geographic location, natural systems, resources, expanding populations, economic and political systems, and development. For Haiti, these factors represent a high level of disaster risk. Thus, nations must develop and invest in preparedness and mitigation strategies in order to mitigate hazardous conditions, lessen the impacts of natural events, and foster recovery—whether based on community knowledge or technological systems implemented by national officials and/or specialized emergency management authorities.

Table 5: Haiti's Casualties Compared to Other Countries after Hurricanes

	Hazel 1954	Flora 1963	Allen 1980	Gordon 1994	Jeanne 2004	Hanna 2008
Bahamas		1				
Canada	100					
Costa Rica				6		
Cuba		1,750	3	2		
Dominican Republic		400		5	19	
Grenada		6				
Guadeloupe			1			
Haiti	1,000	5,000	300	1,122	3,006	500
Jamaica		11	8	2		
Puerto Rico					7	
St. Lucia			18			
Tobago and Trinidad		24				
United States	95	1	2	8	5	

Source: Crystal Andrea Felima (2009), Reprinted with Permission.

Haiti's geographic conditions make the country prone to recurring natural hazards. Bordering the Caribbean Sea and the Atlantic Ocean, Haiti lies within the hurricane belt. Situated on the western third of Hispaniola, Haiti's disproportionately

long coastline and treeless slopes increase the country's vulnerability to severe flooding and mudslides. The convergence of multiple socio-economic and political factors and geographic conditions heightens the country's risk to environmental disasters. Table 5 documents the severity of casualties for Haiti in regards to environmental disasters. Similar to other hurricanes, Haitian casualties disproportionately outnumber other countries that were affected.

Haiti faces multiple environmental issues as a developing, fragile nation without an adequate national response system or governmental agencies to prepare for and manage environmental disasters. An environmental hazard occurrence demonstrates the fragile and unbalanced social and political processes, while highlighting the inequalities of human development. This shows the disaster risk and vulnerability of the Haitian population. The country's capacity to mitigate, lessen the human and social impacts of hazards, and to fully recover from the effects of a natural hazard is restricted. Therefore, the country is unable to fully protect its citizens from the impacts of natural hazards, resulting in persistent crises.

To conclude, Haiti is an environmental disaster by design. Human activity has heightened Haiti's level of disaster risk and human vulnerability to environmental disasters. This has resulted in tremendous devastation—especially in terms of casualties and livelihoods. As shown in Table 5, Haiti outnumbers other neighboring countries that have been affected by the noted hurricane events. In addition to Haiti's geographic location, the degradation of the Haitian ecosystem and the lack of disaster preparedness have heightened the impacts of natural hazards. One can measure such degradation with the loss of life, damage to social structures and livelihoods, and the national economy. Haiti's geographic misfortune and high level of disaster risk is a clear indication of the country's low level of development, which will be discussed in the next chapters.

1.4. VULNERABILITY

This section focuses on risk and the susceptibility of human populations to hazards. Vulnerability, a social function, serves as a crucial element in understanding the social impacts environmental hazards have on human populations. Cardona (2004) defines vulnerability as "an internal risk factor of the subject or system that is exposed to a hazard and corresponds to its intrinsic predisposition to be affected, or to be susceptible to damage" (p. 37). A population's institutional and social systems, degree of (or lack of) mitigation preparedness measures, level of resiliency and livelihoods, and relative exposure to a natural hazard, dictate a population's level of vulnerability and disaster risk. This section aims to explain how vulnerability functions as an underlying factor in how humans are impacted by environmental hazards. If the level of vulnerability is high for a population, then the potential for disastrous outcomes from a natural hazard may be potentially extreme.

Discourse regarding human vulnerability—a concept evolved out of the social sciences—was introduced during the 1970s by scholars and social scientists (e.g., geophysicists, anthropologists, sociologists, and engineers) who questioned the impacts of "natural disasters" (Birkmann, 2006:11; Varley, 1994: 2). These analysts concluded that referring to "disasters" as only natural occurrences is a faulty assumption. Rather, it is the environmental hazard (e.g., a hurricane) that is a natural event; however, the impacts and risks associated with them are not necessarily natural. Therefore, the term "natural disaster" must be re-evaluated and re-assessed in order to accurately represent the realities of environmental hazards and their impacts on human populations.

The word *natural*—used in combination with the word *disaster*—is defined as "living in or as if in a state of nature *untouched by the influences of civilization and society* [italics added]" (Merriam-Webster Online Dictionary, 2010). Therefore, as

stated, the term *natural*—in conjunction with disaster—does not represent or express the experiences and realities of the multiple impacts that affect human populations and their livelihoods. A society plays a critical role in shaping the consequences of a hazard. As a result, in order for a natural hazard to be accurately *and* socially characterized as a disaster, it must include these seven traits:

> *(1) Involve the destruction of property, injury, or/and loss of life*
> *(2) Has an identifiable beginning and end*
> *(3) Is relatively sudden and time-limited (even though the effects may be long lasting)*
> *(4) Adversely affects a large group of people*
> *(5) Be 'public' and shared by members of more than one family*
> *(6) Is out of the realm of an ordinary experience*
> *(7) Is psychologically traumatic enough to induce stress in almost anyone*
>
> (Rosenfeld, et al., 2005:11)

This definition characterizes disasters as being a shared, social phenomenon that disrupt and devastate the livelihoods and social structures of a society. Additionally, Cardona (2004) has noted that, "similar impacts or physical effects [from a disaster] in two separate countries with different economic and institutional conditions could have very different [e.g., social, political, economic, environmental, health] implications" (p. 43). Among classes, populations have varying risks and vulnerabilities; therefore, the term *natural disaster* is misleading and faulty when used to classify commonly avoidable and preventable consequences from hazards. For clarification, alternative and appropriate terms to describe a natural phenomenon include, but are not limited to, *natural hazard, natural event, environmental hazard, environmental event, natural occurrence, and hazard occurrence*. As previously noted, environmental hazards include sudden natural events such as earthquakes or slow-onset hazards such as famine. Therefore, it is misleading to construe disasters as being random events that occur by accident. Trivializing and reducing disasters being

related only to natural occurrences neglects the risks, conditions, and socio-economic realities associated with disasters.

As the National Research Center has stated in *Facing Hazards and Disasters* (2006), "Disasters are not only 'acts of God,' but also 'acts of people'" (p. 65). Human activities and pressures have influenced the conditions and risks for disaster events. A "natural disaster" has often become politicized and handled with technocratic knowledge (e.g., superficial hazard response strategies and policies). Noel Castree (2001) has indicated that technocratic knowledge creates policies that are geared towards ameliorating environmental problems *without* addressing the human systems and activities responsible for these problems (p. 3). In addition, '*technofix'* policies disregard and ignore the vulnerabilities and societal processes of various populations (p. 11). Therefore, a technocratic approach attacks problems on the surface and disregards fundamental socio-economic and political processes and conditions that may be the root causes of disastrous outcomes. This approach must be avoided when considering recommendations and policies for vulnerable populations.

For Haiti, vulnerability determines a disastrous outcome. If the Haitian population is less vulnerable, it is likely that the impacts of natural hazards would be minimal. The growing concern in understanding disasters in Haiti must prompt a re-evaluation of how to assess environmental hazards and their impacts on populations. Instead of utilizing solely technical interventions, vulnerability assessment must be used as a tool in order to examine the direct and indirect impacts of natural hazards on Haitian populations and their environment. With new and innovative techniques, strategies can be more inclusive, allowing for scholars, scientists, and officials to fully assess natural events and their socio-cultural and economic impacts on vulnerable Haitian populations.

Vulnerability is a crucial element in disaster research, mitigation efforts, and humanitarian actions. Noted by Pelling (2003), vulnerability "denotes exposure to risk and an inability to avoid or absorb potential harm" (p. 5). It serves as a function of various components including human behavior, pressures, and actions; a society's socio-economic and political system; disaster mitigation and preparedness efforts; a population's level of resiliency and livelihood; and a population's relative exposure to a natural hazard. There are various types of vulnerabilities, including physical, social, human, and environmental. Physical vulnerability represents "threats to physical structures and infrastructures, the natural environment, and related economic losses" (NRC 2006: 19). Social vulnerability is the potential for disruption to an individual or group and their social, economic, and political systems. It influences a person's or group's "capacity to anticipate, cope with, resist, and recover from the impact of a hazard" (NRC, 2006:73; Wisner, et al., 2004:11). Human vulnerability encompasses the combination of physical and social vulnerability (Pelling, 2003: 5). Lastly, environmental vulnerability can be defined as nature's susceptibility to, or the inability to cope with the effects of external pressures.

Importantly, vulnerability is not necessarily synonymous with poverty. Delica-Willison and Willison (2004) argued that "while poverty is identified as a major factor of increasing vulnerability to hazards, and the poor are more exposed, it is an oversimplification to deduce that poverty and vulnerability are one and the same" (p. 147). In "Vulnerability Analysis and the Explanation of 'Natural Disasters'", Terry Cannon (1994) made an interesting observation explaining that while hazards disproportionately affect the most disadvantaged sections of society, vulnerability and poverty are not the same, but are highly correlated (p. 27). The author defined vulnerability as "an economic element, dependent on people's access to resources and income opportunities, and a variable element of protection against specific hazards."

In comparison, Cannon described poverty as "a consequence largely of class and ethnic position, and in itself may not be an adequate explanation of the differential impact of hazards." While natural hazards can discriminate against the most economically challenged and insecure sections of society, people with resource bundles are not immune from natural hazards. Generally, developed countries and societies are more resilient to disasters in terms of human loss; however, vulnerability is not exclusive to a population's economic condition.

In addition, an environmental hazard can create newly-impoverished people among those who previously had employment or/and resources (Cannon). Multiple factors such as class, ethnic or racial background, geographic location, age, gender, disability, and social exclusion (e.g., these groups which include the homeless, immigrants, undocumented workers, and street children) may place someone at a greater risk than others. In sum, all people suffer from environmental hazards; generally, those who live in developing societies are disproportionately affected. As Hilhorst and Bankoff (2004) have noted, "vulnerability is a much more precise measurement of exposure to risk from these disasters and a more accurate concept than poverty in understanding the processes and impacts of 'underdevelopment'" (pg. 2). Therefore, it is faulty to assume that the Haitian people would automatically be more resilient to the impacts of environmental hazards if they were economically sound.

Highlighted by the Haiti's Vulnerability Equation, disasters in Haiti emerge when the population vulnerability interacts with the forces and pressures of a natural hazard. In *At Risk* (2004), Wisner, et al. have illustrated three elements of a disaster (or risk) with a pseudo-equation: ***risk of a disaster=hazard x vulnerability*** (p. 49). The relationship between vulnerability and risk reflects the link between populations, the environment, institutional and political structures, and the socio-economic system. The

authors have stated that "…there cannot be a disaster if there are hazards but vulnerability is (theoretically) nil, or if there is a vulnerable population but no hazard event." Cardona (2004) has confirmed this assertion by stating:

> *When one or two of the components [hazard or/and vulnerability] are altered, we are meddling with risk itself. However, due to the fact that in many cases it is not possible to modify the hazard in order to reduce the risk, there is nothing left to do except modify the conditions of vulnerability of the exposed elements. This is precisely why emphasis is frequently made in technical literature to study of vulnerability and to vulnerability reduction as a measure of prevention/mitigation. However, what is really intended by this is risk reduction*. (p. 38)

In sum, the risk of disastrous outcomes results from the interaction between a natural hazard and the level of human vulnerability.

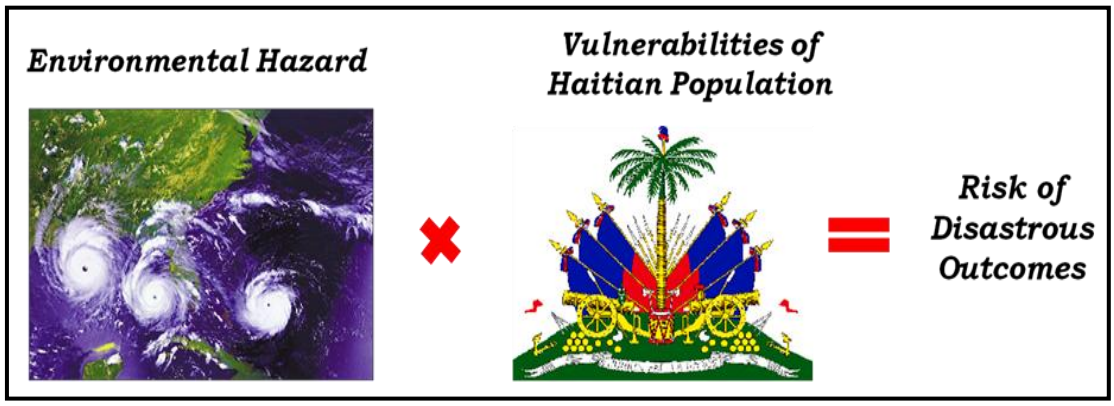


Figure 3: Haiti's Vulnerability Equation
Source: Crystal Andrea Felima (2009), Reprinted with Permission.

Environmental disasters are contingent on the level of vulnerability of a society, and the population's level of vulnerability is dependent on the socio-economic and political processes within the society. Vulnerability speaks to the *risk* of loss and damage to a country's social-economic and political systems, and by extension

threatens the likelihood for a country to achieve and/or maintain sustainable development. Therefore, vulnerability assessment and risk reduction can serve as a useful lens through which the international community, national officials, and the local populations can create strategies and policies for disaster management and human development. In sum, vulnerability assessment forces one to consider the critical disaster-development inter-linkages.

To conclude, this chapter has discussed environmental disasters and vulnerability with the purpose to analyze what is needed for sustainable development in Haiti. As previously discussed, we must combine our understanding of these topics in order to create dialogue on how to approach development and disaster in Haiti since they have been placed on a dichotomy as if these two fields have no influence on each other. Therefore, it is crucial to analyze these fields mutually in order to create a holistic discussion about the condition of and the solutions for the country. At the confluence where these subfields meet, we can begin to consider the challenges of development and Haiti's future.

Any assessment of Haiti's development and environmental conditions must take into account how the country is positioned within a global and regional context. In addition, vulnerability assessment must be considered with sensitivity to socio-economic and political factors which impact environmental degradation and the fragility of the country. The next chapter will reveal Haiti as a disaster-prone built environment that is constantly crippled by the impacts from human activity and recurring hazard events.

CHAPTER 2

Haiti: A Disaster-Prone Built Environment

Déyé mon, gin mon.
Beyond mountains, there are more mountains.

-Haitian Proverb

This chapter is divided into three sections. The first section introduces a brief historical background of Haiti. The second section provides a country profile, highlighting Haiti's geography, economy, population demographics, and social indicators. The third section provides three case studies of Haiti's flooding events of 2004 and 2008. This chapter is meant to link the development of the country and these environmental disasters in order to provide a holistic, in-depth investigation of the situation in Haiti.

Figure 4: Satellite Image of Hispaniola
Source: Google Earth.

2.1. INTRODUCTION

To understand the development of Haiti, a brief history is provided. In 1492, Christopher Columbus happened upon a beautiful island in the western part of the Atlantic Ocean. This island was inhabited by the indigenous people named Tainos (Arawaks). The Arawaks referred to their home as 'Ayiti', meaning 'mountainous land'. Columbus promptly claimed the island for the Spanish crown and renamed it '*La Isla espanola',* the Spanish Island. It was later shortened/Anglicized to Hispaniola. Due to imperialism, the Arawaks were abused, mistreated, and even slaughtered, which resulted in their rapid depopulation to near extinction.

With the rapid disappearance of the indigenous people, the Spaniards turned to an alternative source of labor. The transatlantic traffic of human beings started in 1517. By 1540, an estimated 30,000 Africans were imported to Hispaniola. By 1789, Africans outnumbered the free population four to one—452,000 enslaved Africans in a population of 520,000 (FRD, 2006:2). At the end of the century, Spanish historian Antonio de Herrera observed the change of Hispaniola stating, "there are so many Negroes in this island, as a result of the sugar factories, that the land seems an effigy or an image of Ethiopia itself" (Farmer, 1992: 60-61).

The western part of the island was ceded to the French in 1697 through the Treaty of Rijswijk. Renamed Saint-Domingue, it became the most prosperous colony of the "New World". Due to the colony's economic prosperity, the importation of Africans continued. The extreme mistreatment and abuse from settlers caused a slave revolt in Haiti under the leadership of Toussaint L'ouverture, Jean-Jacques Dessalines, Alexandre Pétion, and Henri Christophe. After a prolonged 13-year struggle for freedom from France, the rebellion became victorious and independence was won on January 1, 1804. On this day, the heroes of independence renamed the island under its original Taino name 'Ayiti' (Haiti) to honor the indigenous peoples.

Haiti emerged as the first Black independent country in the western hemisphere in 1804, the second free nation after the United States. In *The Uses of Haiti* (1994), Paul Farmer stated that Haiti represented the "first free nation of free men to arise within, and in resistance to, the emerging constellation of Western European empire" (p. 71). The Haitian Revolution became a symbol of hope, courage, and determination for Africans who desired freedom, justice, and happiness. Haiti inspired other enslaved Africans in the Americas to revolt and to resist slavery. This became a direct threat to slavery and capitalism.

In order to maintain political interests and power, domestic and international actors restricted and isolated Haiti from participating in the global economy. As a result, Haiti could not advance its position among world powers to achieve self-sufficiency and self-independence. Suggested by D'Agostino and Hillman (2003) in *Understanding the Contemporary Caribbean*, Haiti was "politically quarantined, maligned by many, assisted by few" (p. 196). Haiti was restricted from reaching its optimal potential and developing its *real* independence in the form of economic autonomy and security. Once described as the "Pearl of Antilles" (i.e., one of the wealthiest colonies in the world), Haiti became the poorest nation in the western hemisphere by the end of the 19th century.

Haiti has suffered many years of economic and political instability since its independence, causing insecurity for millions of Haitians and a lack of optimism for a better future. The country's political history can be seen through the framework of authoritarianism, with military interventions from France and the United States and long periods of internal conflict, factional disputes, and corruption from armed forces and political leadership. The most oppressive political experience in Haiti was the dictatorship of François Duvalier from 1956 to 1986. In *Haiti: The Breached Citadel* (2004), Patrick Bellegrade-Smith has described this period as "the most brutal

experience by Haiti in two centuries of national life" (p. 128-129). Further noted by Bellegrade-Smith, roughly 20,000 to 50,000 Haitians were said to have been murdered by the government, and about one-fifth of Haitians migrated abroad in political or economic exile—the second-highest ratio in the Western Hemisphere. By the mid-1960s, an estimated 80 percent of Haiti's skilled professionals and college-educated had joined the exodus due to political and economic challenges (p. 129). To date, this figure has not changed. Eighty percent of Haiti's college-educated remain outside the country, a figure including 30 percent of Haiti's physicians (Buss and Gardner, 2008; IOM, 2008; Fajnzylber and López, 2008). Political instability, corruption, and the absence of good governance remain a critical issue in Haiti and its population. In summary, Haiti has experienced many political and economic challenges since its founding. As a result, the development and environmental crises have taken a toll on the nation's prosperity and on the well being of its citizens.

2.2. COUNTRY PROFILE

2.2.1 *Geography and Natural Resources*

> *A nation's geography determines many of the country's options. The wealth or poverty of its soil and the pattern of its international and domestic relations over time are factors that determine both the potential and the limitations of a nation's development.*
>
> -*Haiti: The Breached Citadel* (2004)
> Patrick Bellegrade-Smith

Haiti is a small island[10] located in the Caribbean. The country is the third largest country in the Caribbean behind Cuba and the Dominican Republic. Haiti

[10] Haiti has an area of 27,750 square kilometers (10,714 square miles) including the islands of Tortuga (La Tortue), Gonâve, Les Cayemites, and Vache. Comparatively, Haiti is slightly smaller than the US state of Maryland.

occupies the western third of Hispaniola, which is the second largest island of the Greater Antilles. Hispaniola is divided between Haiti and the Dominican Republic, sharing a 388-kilometer (241 mile) broader established by a series of treaties—the most recent being the Protocol of Revision of the Frontier Treaty of 1926 signed at Port-au-Prince on March 9, 1936.

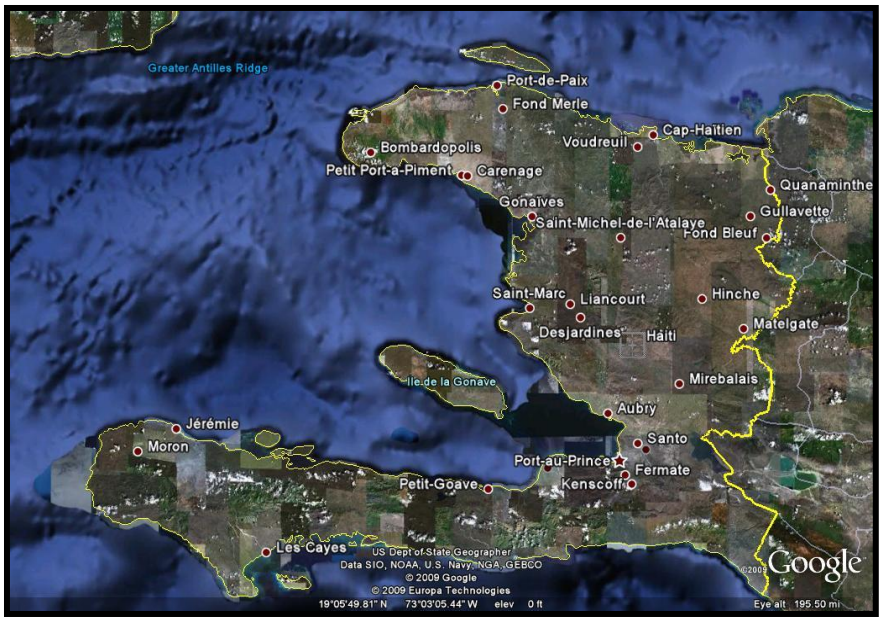


Figure 5: Satellite Image of Haiti
Source: Google Earth.

Haiti is bounded on the north by the Atlantic Ocean, on the east by the Dominican Republic, and on the south and west by the Caribbean Sea. The Windward Passage separates Haiti and Cuba by 80 kilometers (50 miles). The country has a total land boundary length of 360 kilometers (224 miles),[11]and a disproportionate and irregular coastline of roughly 1,771 kilometers (1,100 miles). The coastline forms a long southern peninsula and a shorter northern peninsula between the Gulf of Gonâve.

[11] The boundary length is measured at a scale of 1:100,000. The length has been previously recorded at 271 kilometers (171 miles), calculated from measurement on a map at a scale of 1:820,000. Measurement on a larger scale map will give a greater mileage since more irregularities, especially along rivers, will appear and be measured (US Department of State-Office of Geographer, 1961:2).

Twenty percent of Haiti lies from sea level to about 180 meters (600 feet), and 40 percent of the nation is at elevations more than 450 meters (1,500 feet) above sea level, making the soil susceptible to erosion by torrential storms (Bellegarde-Smith, 2004:14). The country has two seasons—wet and dry—and an annual average rain measure of 1300 millimeters (from 400 to 3000 millimeters).

Rugged mountains cover 80 percent of Haiti, with the remainder of the country marked by river valleys, plains, and extensive coastal plateaus. Plains cover 22 percent of the nation's territory. Sixty-three percent of Haiti's mountainous land has slopes greater than 20 percent, and only 29 percent of the country has less than a 10 percent slope (Smucker, 2001:315). Haiti's terrain limits the agricultural sector, with an annual soil loss of approximately 36 million tons. Soil erosion represents a serious problem for water development projects, coastal marine resources, lands and streams, and crop production.

Agriculture, together with forestry and fishing, accounts for approximately one-quarter of Haiti's annual gross domestic product (GDP) and employs about two-thirds of the labor force (FRD, 2006:13). However, by agronomic standards, 63 percent of the country's land is too steep for agricultural production (Smucker, 2001:315; FRD, 2006:6). Arable land is estimated at 28 percent, and more than 40 percent of the land is cultivated. Two-thirds of all cultivated land is on mountains slopes, and the majority of food production on mountain slopes is intensive crops. This increases the land's susceptibility to erosion and soil degradation.

Haiti was lush with 60 percent forestation in 1923. Throughout the decades, the Haitian population has cut millions of trees for fuel and energy. Today, Haiti has less than 2 percent of its original forest cover. The severe deforestation has destroyed fertile soils, caused severe erosion, and exacerbated flooding. Figure 6 shows a striking contrast in forestation between Haiti and the Dominican Republic. Haiti

maintains 80 percent of its energy needs primarily by wood in rural areas and wood charcoal in urban areas (Smucker, 2001: 320). As Smucker (2001) noted, "Haiti's forest cover is fast disappearing because of the press of people on the land, the clearing of land for food production, growth in the demand for construction material, and the harvest of fuelwood" (p. 319).

Figure 6: Haitian-Dominican Border
The border between Haiti (left) and the Dominican Republic (right).
Source: NASA/Goddard Space Flight Center, Scientific Visualization Studio.

Deforestation in Haiti has attracted international attention, which has led to numerous reforestation efforts. However, these initiatives have had little success to date. In the *Haitian Dilemma* (1996), Ernest H. Pregg (1996) noted, approximately 10 million trees grew annually in Haiti by 1990 due to reforestation efforts in the 1970s and 1980s. However, tree cutting accelerated during the political crisis period of 1991-1994 (p. 35-37). Therefore, reforestation efforts have been virtually ineffective and counterproductive.

Figure 7: Haiti's Deforested Mountains
Source: Photo by Crystal Andrea Felima (2010)

While Haiti faces environmental devastation, the country is rich in biodiversity. Haiti is home to more than 5,000 plants of which 36 percent are endemic, and 220 species of birds of which 21 species are endemic. Noted by Smucker (2001), the major threats to wildlife are population pressures; habitat destructions; hunting non-native species; lack of government regulation; inadequate regulation of biological exports; and weak national institutions for biodiversity protection and management (p. 323).

2.2.1 *Population Demographics*

Two centuries of political independence have not altered Haiti's economic hardships: approximately 80 percent of the population lives in poverty, making US $2 a day, and roughly 60 percent of the population lives in extreme poverty. Mats Lundahl (2004) noted that Haiti is on the same level as Sub-Saharan Africa, with only

eight such African countries having a higher incidence of poverty than Haiti (p. 2). Haiti's per capita GDP has declined over the past decades. In 1980, Haiti's per capita GDP was US $632, and by 2003 it had fallen to US $332 (Verner and Egset, 2007: 15). In terms of distribution of GDP by economic activities, the service sector accounts for 45 percent of total GDP (including energy at 2 percent), agriculture at 24 percent, construction at 21 percent, and the industrial sector at 10 percent (MPWTC, 2004).

In 2001, the median income per capita of extremely poor households (1,080 gourdes/US $27) was approximately one-tenth of the median income of the non-poor (10,304 gourdes/US $257.60) (Verner and Egset, 2007:11)[12]. In addition, metropolitan households earn roughly four times more than rural households because of employment opportunities and resource access (p. 11-12). According to the Federal Research Division (FRD) (2006), two-thirds of the Haitian population is unemployed, job opportunities are extremely limited, and only 1 in 50 Haitians has a steady wage-earning job. Noted by Buss and Gardner (2008), roughly two-thirds of entrepreneurs operate outside the law, and ninety-five percent of employment exists in the underground economy where workers receive no benefits, pay no taxes on income, and engage in illegal activities (p. 11). The minimum wage is 70 gourdes (US $1.40) per day. The Haitian Parliament voted in May 2009 to increase the country's minimum wage to 200 gourdes (US $4) per day; however, the law did not pass. Haitian President René Préval declined to sign the plan into law. Instead, the President offered to raise the minimum wage to 125 gourdes (US $2.5) per day. Legislators approved President Préval's proposal in August 2009 (Wong, 2009). Wages and incomes, self-employment, and education are crucial in escaping poverty in Haiti (Lundahl, 2001; Verner and Egset, 2007).

[12] Exchange Rate: 1 Haitian Gourde = 0.025 US Dollars as of 12/26/2009

The Haitian Diaspora serves as an important lifeline for Haiti's economy. Noted by Verner (2007), internal and external money transfers amounted to more than US $1 billion in 2004. Eighty percent of these transfers came from Haitians living abroad (p. 26). Approximately one out of every eight Haitians presently lives abroad (Federal Research Division, 2006:12). Roughly 30 percent of Haitian families have relatives abroad, and 27 percent of them receive remittances (Fajnzylber and López, 2008).[13] Seventy-two percent of these migrants live in high-income countries such as the United States and Canada (Verner, 2007:25).

At the macroeconomic level, remittances play a significant role: in 2005, remittances represented about 25 percent of Haiti's GDP[14] (Fajnzylber and López, 2008; World Bank, 2008b). However, remittances in Haiti may not affect the mass majority of Haitians who are among the poorest, marginalized sections in society. In "Remittances and Rural Development" (2004), Rosemary Vargas-Lundius suggested:

> *It is not the poorest of the poor who migrate abroad, but rather the "relatively poor." When the most educated or most resourceful workers leave their country of origin, the poorest and most disadvantaged are not always able to benefit from remittances.* (p. 6)

As noted, more than 80 percent of college-educated persons born in Haiti live abroad, mostly in the United States. Therefore, as the World Bank (2008b) has suggested, remittances in Haiti tend to benefit the Haitian "middle" class rather than the majority of the poor.

Table 6 shows a comparison of social indexes between Haiti, the Dominican Republic, and the United States. The disparities between Haiti and the DR are evident in their human development and social conditions. These are substantial differences in

[13] While the range is wide, remittances average US $180 per household per year (Verner, 2007:26).
[14] Estimates suggest that extricates send home roughly US $700-900 million per year (Verner, 2007:25).

development, even though these two countries share the same island. Here, one can see that Haiti's long history of political and economic instability has affected the development and sustainability of its citizens.

Table 6: Haiti's Comparison to the Dominican Republic and United States

	Haiti	Dominican Republic	United States
Population	9,035,536	9,650,054	307,212,123
Population Growth	1.838%	1.489%	0.975%
Median Age	20.2 years	24.9 years	36.7 years
Life Expectancy Rate	60.78 years	73.7 years	78.11 years
Death Rate per 1,000	10.15 deaths	5.3 deaths	8.27 deaths
Birth Rate per 1,000	35.69 births	22.65 births	14.18 births
Infant Mortality Rate	59.69 deaths	25.96 deaths	6.26 deaths
Literacy	52.90%	87%	99%
GDP (per capita)	$1,300	$8,100	$47,000
Unemployment Rate	66%	15.4%	7.2%
Oil Production: Consumption (barrels)	0 bbl/day: 12,370 bbl/day	12 bbl/day: 117,300 bbl/day	8.5 mil bbl/day: 20.68 mil bbl/day
Telephones (Cell and Land Lines)	2.6 million	6.4 million	418.2 million

Source: Updated by Crystal Andrea Felima with CIA Country Profiles (2010). This table was originally printed in Felima's article in the *Journal of Haitian Studies*.

Haiti's level of poverty can be measured by social indicators such as literacy and education, infant mortality, and malnutrition. Haiti is one of the most densely populated countries in the Americas with an estimated population of 9 million, a population growth rate at 1.838 percent, and an average population density of 300 inhabitants per square kilometer (Port-au-Prince's population density is more than double). From 1990 to 2010, the country's population increased from 6.486 to 9.035 million inhabitants—a 39.3 percent rise in 20 years. The birth rate is estimated at 29.1 births per 1,000, and one third of babies are born underweight. The infant mortality

rate is 60 deaths per 1,000 live births, and the death rate is about 8.65 deaths per 1,000. Roughly 38 percent of the Haitian population is under 14 years of age, 59 percent at 15 to 64 years of age, and 3 percent over 65 years of age. The median age is at 20 years old, and the life expectancy at birth is approximately 61 years. One in five Haitians die before the age of 40 years of age. Noted by the World Food Programme (WFP) (2010), rural households in Haiti spend up to (or higher) 60 percent of their income on food. In addition, chronic malnutrition affects 24 percent of children under five years old, and undernourishment affects 46 percent of the entire population. Anemia affects two-thirds children between the ages of six months and 5.

The low literacy rate of 53 percent (roughly 55 percent for males and 51 percent for females)[15] is a critical issue that plagues the country's development and economic prosperity compared to other countries in Latin America and the Caribbean[16]. As noted by the United States Agency for International Development (USAID) (2007), less than 30 percent of Haiti's children who enter primary school will reach the sixth grade. With an annual per capita income of less than US $400, the cost of education—ranging from US $100 to US $500 per student, per year—challenges families' income resources. In addition, Haiti has a total of 14,424 private schools and 1,240 public schools located mainly in urban areas (Egset and Kuttner, 2007: 51). The vast majority of these non-state schools do not receive government subsidies. The FRD (2007) noted that 90 percent of Haitian students are educated in non-state, private fee-based schools (run by Canada, France, or the United States) and/or parochial schools (p. 11). Haiti continuously faces severe shortages in educational resources and qualified teachers, a lack of investment in education, and

[15] Literacy rate is defined by the CIA as total percentage of individuals 15 years and over who can read and write.

[16] As noted by the FRD (2007), Haiti's literacy rate is below the 90 percent average literacy rate for Latin America and the Caribbean (p. 11).

educational disparities in school attendance between students from various locations, age levels, and incomes.

Haiti's development and resources reflect the country's opportunities, disadvantages, and realities. Haiti's state of socio-economic and political fragility has created a disaster-prone built environment. Human activity, political choices, and the geographic location of this island have created a high level of vulnerability. As a result, the country and the Haitian population are at risk of disasters from frequent environmental events such as hurricanes, mudslides, and flooding. The following section will highlight these extreme natural hazards with three flooding events. These case studies were selected based on existing and increasing disaster research and vulnerability assessment, which suggests that disasters in Haiti are not simply natural; they are caused by multiple socio-economic and political factors that generate the country's high level of vulnerability. The following case studies will inform and support this assertion.

2.3. CASE STUDIES:

2004 AND 2008 NATURAL HAZARD EVENTS IN HAITI

In regards to environmental crises, the last decade has been extremely overwhelming for Haiti, exacerbated primarily by severe flooding from heavy rains. The first case study will highlight the southern border area between Haiti and the Dominican Republic. For Haiti, the area surrounding the towns of Mapou in the South East Department, and Fond Verettes in the West Department, were notably devastated. In the Dominican Republic, the Provinces of Independencia (the town of Jimaní, located on the border with Haiti), Elias Piña, Duarte and Sanchez Ramirez (the Bajo Yuna region) were largely affected by the flooding. Reported by the IFRC-CRCS, many affected persons in the Dominican Republic were Haitian migrants, mostly undocumented. Deforestation—which is discussed in the next chapter—and

geographic location contributed to the towns' and villages' environmental vulnerability.

Two case studies involve the city of Gonaïves, Haiti. Over the past years, Gonaïves has been devastated by the impacts of hurricanes and flooding. With a population of 350,000, Gonaïves is the fourth largest city in Haiti and is known as the birthplace of Haitian independence. This coastal city is approximately 150 kilometers (93 miles) north of Port-au-Prince. It is situated "in a flat river plain between the ocean and deforested mountains that run with mud even in light rains (Katz, 2008)." As stated, populations located along coastlines are particularly prone to environmental hazards such as flooding. In addition, the city's vulnerability has been exacerbated by deforestation and the vulnerability of the Haitian residents.

2.3.1. *Case Study 1: May 2004 Floods*

In May 2004, a low-pressure system from Central America crossed the Caribbean and affected Hispaniola with heavy rains and thunderstorms. These rains caused rivers to overflow or break their banks, inundating surrounding towns and villages. In summary, the causes of devastation in Hispaniola were the intense rainfall event, the location of the towns, and the deforestation in the upper catchment of the Soliel River found within Haiti's borders.

As described by Brothers, Wilson, and Dwyer (2008), the first rain event occurred in the watershed of Soliel River (Riviére Soliette), which rises from short, steep tributaries in the Massif de la Selle in southern Haiti and drops through Arroyo Blanco, a deep gorge, which emerges on an alluvial fan in the Dominican Republic. Rainfall amounts of 500 millimeters (19.7 inches) caused the Soliel River to overflow its banks (see Figure 8). From May 24th to 25th, the river rose, inundating the Haitian

mountain town of Fonds Verrettes[17] and bursting from Arroyo Blanco down into the city of Jimaní, which is located on the alluvial fan (p. 64). The Dominican Disaster Mitigation Association (ADMD) (2004) reported that 247.8 millimeters (9.8 inches) of rain fell in Haiti in just 24 hours.

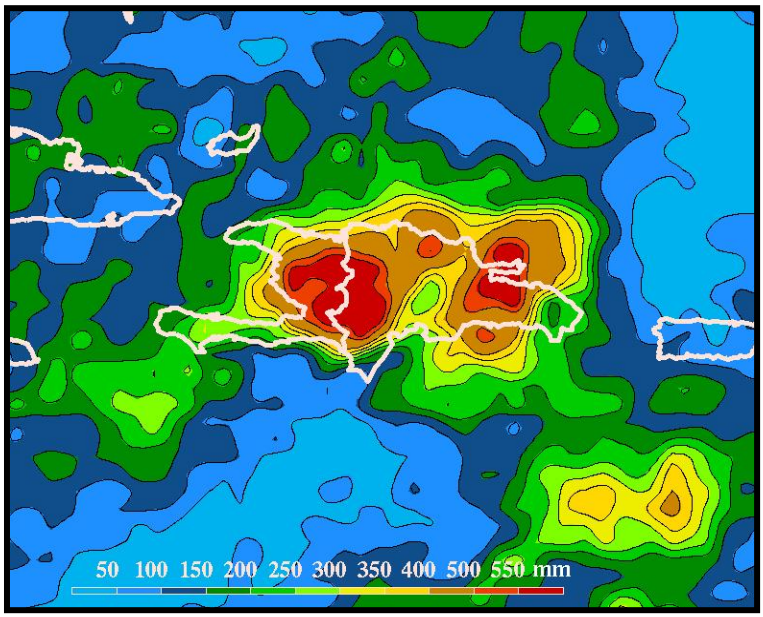


Figure 8: Rain Accumulation through May 18-25, 2004
Source: Picture courtesy of NASA.

One of the most severely affected areas was southeast Haiti, shown in figures 9 and 10. Taken on May 30th, 2004, Figure 10 shows dark blue lakes that were dry on October 26th, 2003 (Figure 9). Flood debris is displayed as shiny light blue tracks, vegetation is highlighted in red, and the bare land colored in shades of grey. Noted by the IFRC-CRCS (2004c), the Haitian villages of Barois (Bawa), Nan Roche and Saint Michel are particularly vulnerable to future flooding should heavy rainfall in the region continue (p. 2).

[17] Noted by Brothers, Wilson, and Dwyer (2008), Fonds Verrettes was still recovering from Hurricane Georges in 1998.

BEFORE AND AFTER PHOTOS OF AFFECTED AREA FROM MAY 2004 FLOODS

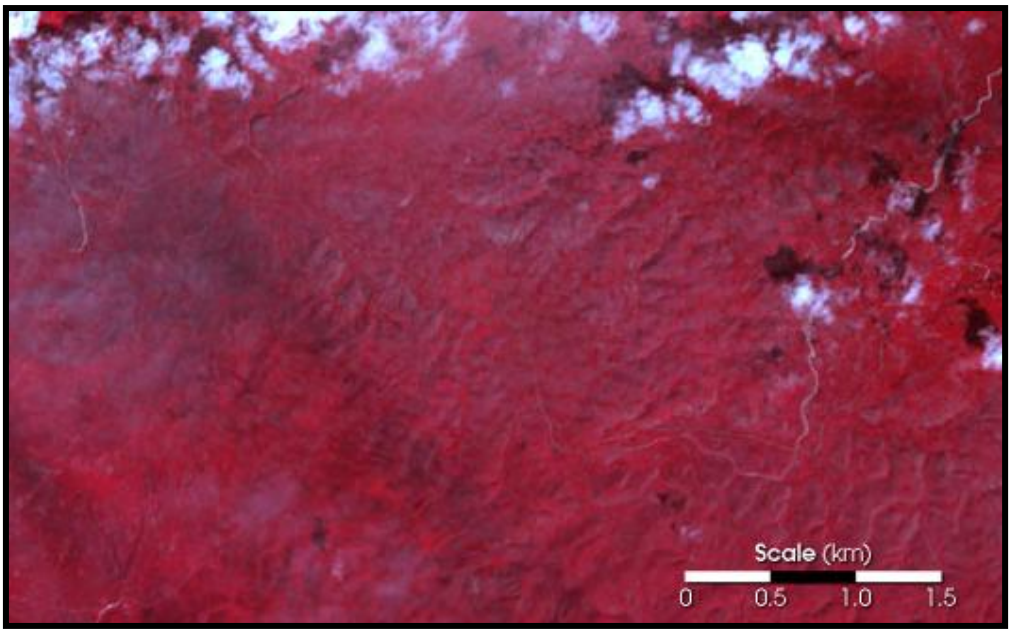


Figure 9: Satellite Imagery of Pre-Disaster, October 26, 2003
Source: Picture Courtesy of NASA.

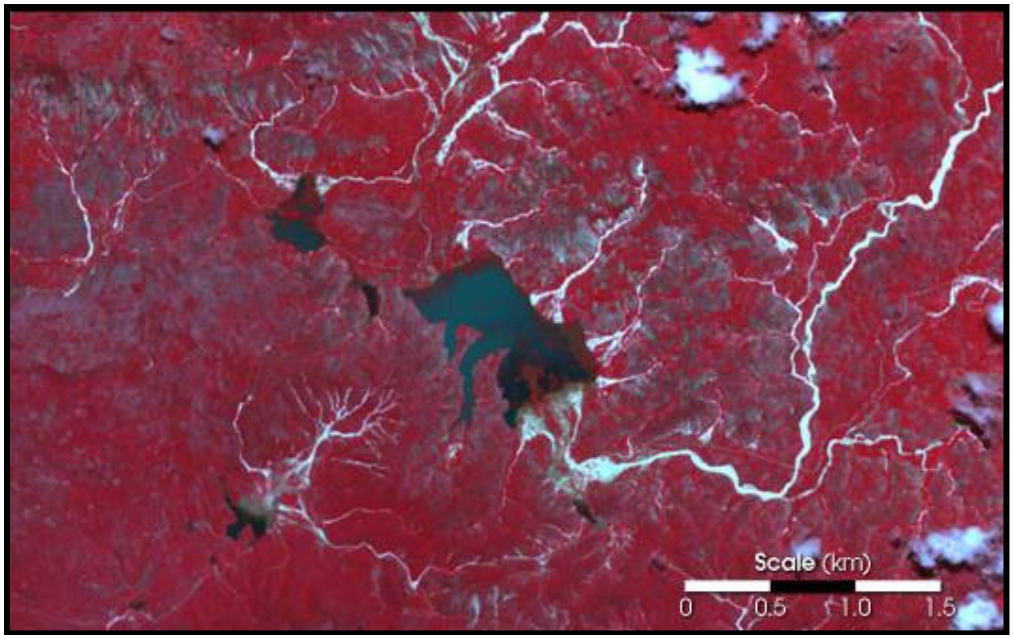


Figure 10: Satellite Imagery of Post-Disaster, May 2004
Source: Picture Courtesy of NASA.

Consequently, flooding resulted in 2,665 confirmed deaths in Haiti, and 688 deaths in the Dominican Republic (EM-DAT). As noted earlier, many Haitian migrants, most undocumented, were primarily affected in the Dominican Republic. The international community responded to the affected population. Compiled by the United Nations' Office for the Coordination of Humanitarian Affairs (OCHA), the global community provided over US $12 million in humanitarian aid contributions, commitments, and/or pledges.

2.3.2. *Case Study 2: Hurricane Jeanne in 2004*

The 2004 Atlantic Hurricane Season saw a total of 14 named tropical cyclones and nine hurricanes. Six intense hurricanes lasted for 22.5 days, the most major hurricanes days since the 1926 season (Gray and Klotzbach, 2005:20). The notable storms of season were Charley, Frances, Ivan, and Jeanne, causing damages in the billions. Specifically, Hurricane Jeanne—the tenth storm—caused approximately US $7 billion in damages and over 3,000 deaths in the Bahamas, United States, Puerto Rico, and Hispaniola combined.

Described by Gray and Klotzbach (2005), Jeanne developed as a tropical wave on September 13th and became classified as a tropical storm on the 14th while located approximately 241.4 kilometers (150 miles) southeast of Saint Croix. It developed into a hurricane after passing Puerto Rico where it caused roughly US $200 million in damages. The steering currents around Jeanne collapsed, and the system stalled over Hispaniola on September 18th, causing intense devastation. For approximately 30 hours, the storm produced heavy rains in the region. Jeanne had weakened to a tropical storm due to interaction with the land. By September 19th, the system drifted north and intensified back to a hurricane. By September 26th, Hurricane Jeanne made landfall in other countries causing damages. The next day, the hurricane dissipated while tracking north across Georgia.

PHOTOS OF AFFECTED AREA IN GONAÏVES, HAITI BEFORE AND AFTER

Figure 11: Satellite Imaginary of Pre-Disaster, Gonaïves. September 17, 2000
Source: Courtesy of Geoeye Inc. Copyright 2010. All Rights Reserved.

Figure 12: Satellite Imagery of Post-Disaster, Gonaïves. September 22, 2004
Source: Courtesy of Geoeye Inc. Copyright 2010. All Rights Reserved.

Tropical Storm Jeanne produced heavy rains, which caused severe flooding and mudslides from September 19th through 22nd in Haiti. The satellite images reveal how much the city of Gonaïves—the hardest hit region, in terms of deaths—was affected by heavy rains. Figure 12 illustrates water and mud covering nearly the entire area. Gonaïves is located at the bottom of the *La Quinte River*. The watershed of the river suffered from heavy rains, which produced just enough water volume for the river to overflow its banks that flooded the surrounding area. Eighty percent of Gonaïves was underwater for three days. Clogged sewage canals, filled with debris and waste (see Figure 13) that had not been cleaned in years, exacerbated flooding conditions in the city. Roughly 80 percent of residents became homeless, and a reported 2,826 people lost their lives (Dartmouth, 2005). OCHA (2004) reported approximately 1,170 children were among Gonaïves' casualties (p. 4). Port-de-Paix, a city located in northern Haiti, was also impacted by Jeanne. Thirty percent of the city flooded and there was extensive crop damage (Dartmouth, 2005).

Figure 13: Clogged Drains in Cap-Haïtien, Haiti
Source: Photo by Crystal Andrea Felima (2010).

In summary, Jeanne affected the entire area between Gonaïves, Ennery, Port de Paix, and Anse Rouge. Combined, there were over 3,000 deaths, 2,600 injuries, and 300,000 affected persons. Ten percent of schools were destroyed, water and sanitation systems were washed out, and irrigation systems covering thousands of farm acres were destroyed (USAID, 2005). Many of Haiti's dead remained unburied for days, and some bodies were washed out to sea. Reported in October 2004, New Scientist magazine reported that more than 1500 bodies were buried in large graves in attempts to avoid the spread of waterborne diseases.[18]

Jeanne caused damages estimated to be 3.5 percent of the Haiti's GDP (Buss and Gardner, 2008:13). The international community responded to the affected area. Noted by Fagen (2006), OCHA issued an emergency appeal for US $32 million for the affected population. Compiled by OCHA, the global community contributed, committed, and/or pledged over US $43 million in humanitarian aid and relief supplies. The Haitian Diaspora also provided relief and support, channeling their contributions through international aid agencies, local churches, and relief committees (Fagen, 2006).

2.3.3. *Case Study 3: 2008 Atlantic Hurricane Season*

The 2008 Atlantic Hurricane Season (extending from May 31st to November 9th) produced sixteen named storms (winds ≥39 mph), including eight hurricanes (winds ≥74 mph)—five of which were major hurricanes at Category 3 or higher with winds exceeding 111 mph. Noted by the National Oceanic and Atmospheric Association (NOAA) (2008), this season is tied as the fourth most active season in terms of named storms and major hurricanes since 1944—the first year reconnaissance

[18] This article "No need for mass graves" reported that health officials have suggested that bodies should not be buried in mass graves based on the fear of the spread of diseases. As noted, individuals handling corpses can protect themselves with simple precautions (i.e., using body bags for bodies and wearing gloves for workers). A person or population is at risk only if corpses contaminate the water supply.

BEFORE AND AFTER PHOTOS OF AFFECTED AREA IN GONAÏVES, HAITI

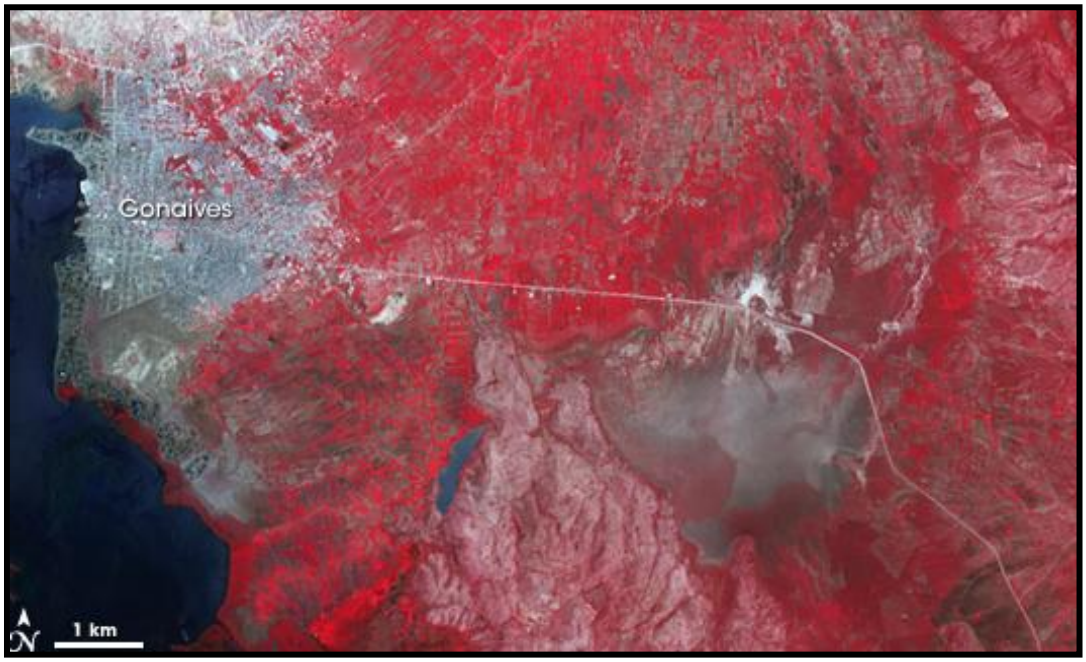


Figure 14: Satellite Imaginary of Pre-Disaster. August 8, 2001
Source: Courtesy of NASA.

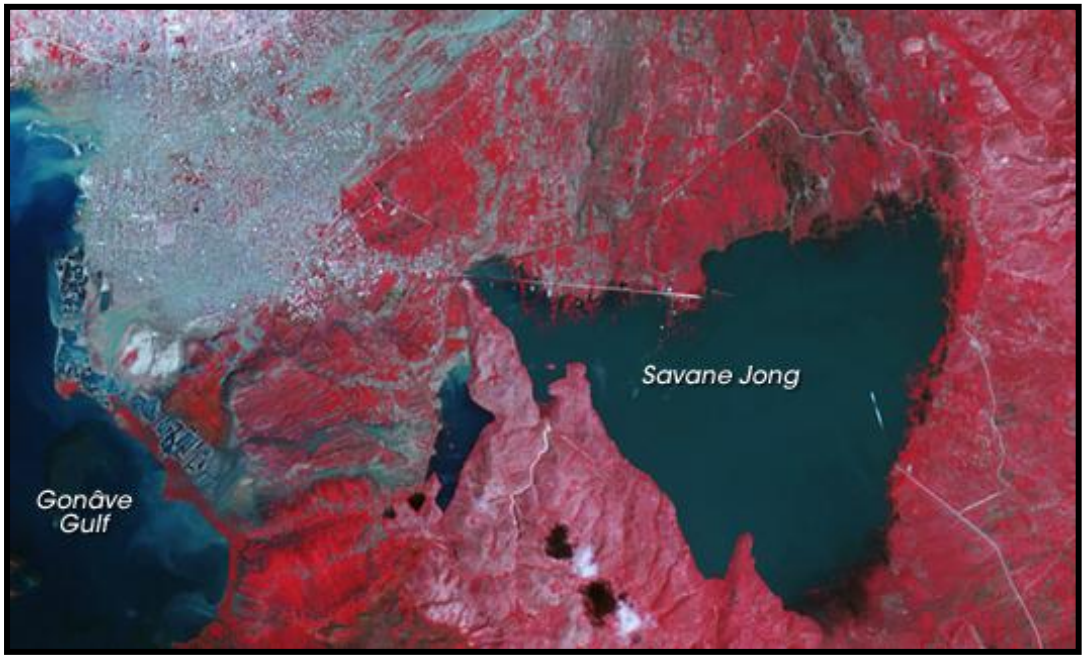


Figure 15: Satellite Imaginary of Post-Disaster. September 12, 2008
Source: Courtesy of NASA.

aircraft flew into tropical storms in order to provide weather reports in storm areas and to improve weather observation reliability. Economic damages totaled approximately US $54 billion, the second most destructive hurricane season on record[19].

The impacts from the 2008 Atlantic Hurricane Season were a mirror image of what happened in 2004 in Haiti. In a mere 2 weeks, 4 major hurricanes—Fay, Gustav, Hanna, and Ike—caused severe devastation in the country. On August 15th, Fay produced heavy rains on the island of Hispaniola, causing extensive flooding. Gustav made landfall on the southwest peninsula of Haiti, approximately 10 miles west of Jacmel on August 26th. Hanna brought heavy rains on September 1st and affected mostly the northern coast of the country. Days later, Ike reached Haiti and affected the northern and southern departments, including the city of Gonaïves. As in 2004, roads and bridges were damaged, preventing humanitarian vehicles access to the affected areas and restricted residents from leaving the area. The hurricanes caused roughly US $1 billion in damages—equivalent to about 15 percent of Haiti's GDP (Taft-Morales, 2009).

Heavy rains from the storms flooded the fertile Artibonite River basin, where many crops are grown. The floods devastated fields, animals, seeds, and farm equipment. Agricultural production damages amounted to almost US $200 million. Despite Haiti's food crisis earlier that year which led to several protests and riots, the country was expecting an influx of food for the 2008 harvest year. Haitian farmers had invested in the capital for crop production; therefore, they were adversely affected by these storms (US, 2008: 22-23). The storms destroyed approximately one-third of the country's rice crops, as well as mangoes and plantains. Stated by Taft-Morales (2009), rice makes up 20 percent of a Haitian's diet. Since the storms hit during the harvest season and devastated farmers' investment in crop production for that year, farmers

[19] The most destructive hurricane season was in 2005 with a total of US $128 billion in damages.

lacked the capital to reinvest in crops for production (US, 2008; Taft-Morales, 2009). Noted by the US (2008), Haiti's crop losses left the country vulnerable to rising world commodity prices and heavily dependent on foreign imports.

The 2008 hurricane season impacted nine out of ten regions of Haiti, affected more than 800,000 people, and damaged or/and destroyed over 100,000 homes. Housing losses and damages amounted to roughly US $180 million. In addition, the storms caused over 150,000 displaced persons, 793 casualties, 310 declared missing persons, and 548 injured individuals in the country (IFRC-CRCS, 2008; USAID, 2008). For Gonaïves, there were 300,000 affected persons (nearly half were children), 506 casualties, 255 declared missing persons, and 5,447 houses destroyed. Submerged under two meters of water, 80 percent of the city was flooded. Additionally, floodwaters left approximately 3,000,000 tons of mud (IFRC-CRCS, 2008).

On September 18th, Haitian Ambassador to the United States Raymond Joseph recommended that Haiti needed $400 million for hurricane recovery and reconstruction for 18 months. As with previous environmental disasters, the international community provided humanitarian support for the affected Haitian population. OCHA issued an international flash appeal for about US $108 million for Haiti's recovery. By October 23rd, contributions and commitments of humanitarian assistance amounted to roughly US $25 million, with US $16.9 million pledged, but not yet committed (Taft-Morales and Sullivan, 2008). The United States government provided over US $33 million in humanitarian assistance after the hurricanes. By December 18th, aid worth amounted to about 48 percent of the flash appeal, including US $40 million outside of the appeal (e.g., projects and relief aid from NGOs and in-kind and bi-lateral donations to the Haitian Government).

2.3.4. Summary

These case studies reflect the perpetual environmental crises in Haiti. As illustrated in Tables 4 and 5 of Chapter One, Haiti clearly outnumbers other affected countries after a hazard event. Here, it is evident that Haiti suffers from environmental hazards due to causes that are not necessarily natural. As the thesis title suggests, the country suffers from multiple jeopardies, which heightens the level of vulnerability and disaster risk for the Haitian population. The next chapter will analyze these dangers and conditions in order to provide solutions to address underlying issues of Haitian vulnerabilities.

CHAPTER 3

Haitian Vulnerabilities: Primary Causal Factors and Solutions

Men anpil, chay pa lou.
Many hands make a workload lighter.

-Haitian Proverb

As stated, Haiti is an environmental disaster by design. Socio-political choices have undermined the current structures of the society. This has caused an increased challenge to Haiti's response to environmental hazards. Scholars, scientists, global actors, national decision-makers, and the local community must advocate for new policies in order to address the complexities of development and disaster risk in Haiti.

Environmental disasters reveal the nation's underlying socio-economic, political and environmental problems within the country. These events pose great threats and challenges to development as they cripple existing projects and divert financial resources from development programs to disaster-related events. Therefore, natural hazards can challenge social and educational progress, economic growth and security, transportation and infrastructure, health institutions and social welfare systems, as well as communication networks and technological development.

This chapter aims to address two important questions concerning Haiti's environmental and disaster crises: *What are the casual factors? What are some solutions?* As highlighted by the case studies, Haiti is disproportionately and adversely affected by natural hazards. Therefore, it is important recognize, address, and alleviate the disaster risk factors in order to promote development and to protect the livelihoods of vulnerable Haitian populations.

The first section, “Haitian Jeopardies”, stresses the underlying conditions of vulnerability to environmental hazards. Combined with Haiti’s geographic location, the country is adversely impacted by environmental disasters by these factors: political instability and government irresponsibility, the country’s low level of development and inadequate financial resources, population growth and density, and deforestation and environmental degradation. These factors, highlighted in this chapter, contribute to an increase in vulnerability and disaster risk for the Haitian population. As a result, human development and the national economy are undermined.

The second section, “Recommendations and Solutions”, builds on the on-going conversations of possible solutions for Haiti. In order to tackle Haiti’s fragile environment, to promote development, and to implement sound strategies that address causal factors of disaster risk, various solutions such as governmental responsibility and poverty eradication, environmental and disaster management, international assistance and restructuring of aid, and community participation are proposed. In order to pursue these recommendations, a collective effort from international, national, and local actors must be pursued as a means to enhance the effort to alleviate the multiple jeopardies in Haiti.

In summary, this chapter aims to link the connections between disaster risk and the issues of development to address Haiti’s crises. Disasters cripple development; therefore, disaster mitigation and the promotion of development are critical in addressing the key issues of vulnerability and disaster risk. As stated, the socio-economic and political vulnerabilities of Haiti are the primary causal factors of environmental degradation and disaster risk on a national level. Sustainable development in Haiti must be approached through the reduction of these vulnerabilities in order to maintain and/or increase the resiliency and to protect livelihoods of the Haitian people.

3.1. HAITIAN JEOPARDIES

The notion of multiple jeopardies reveals the multiple *interconnected* and *interrelated* issues that contribute to the vulnerability of the Haitian population. These issues confront the population on a daily basis, endangering all facets of development within the country. In order to promote disaster mitigation and preparedness strategies, environmental management, and development initiatives, the underlying issues that influence vulnerability must not be overlooked and ignored.

3.1.1. *Political Instability and Government Irresponsibility*

The sources of Haiti's political problems are many. Since European colonization, Haiti's political history can be characterized as unstable, paternalistic, repressive, and violent. By way of example, Haiti has had fifty-five "presidents". As mentioned by Buss and Gardner (2008):

> *Of these, three were assassinated or executed, seven died in office (one by suicide), and twenty-three were overthrown by the military or paramilitary groups. Two—Henri Namphy and Jean-Bertrand Aristide—were overthrown twice. Only nine completed full presidential terms. Thirty-one held office for two years or less. In 1946 and again in 1988, a military junta ruled without a president. Nearly all presidents either were military officers or were closely affiliated with the military. Throughout Haiti's history, many presidents have attempted to become rulers for life. Every president has exploited Haiti's impoverished people and its resources, for political gain or personal aggrandizement or both. There have been very few months in its history when Haiti went without a revolt, uprisings, riots, political murders, or mass killings. During the twentieth century, the United States compelled five presidents to leave office.* (p. 21)

The long history of political instability and poor governance has shaped the nation's current socio-economic and political systems today. Haitian leaders have not placed the population's interest at the forefront of the nation's political and economic agenda. Instead, internal actors have been unaccountable and irresponsible, fueled by self-interests, egoism, and/or individual aggrandizement. Surveyed in the Transparency

International's 2009 Corruption Perception Index, Haiti is ranked 168 among the 180 countries[20]. The government's poor leadership and lack of vision has crippled development and contributed to the inadequate resources to support the Haitian people.

In the wake of disasters, it is the State's responsibility to save and protect lives and to deploy resources. However, the Haitian government is ill prepared for such actions. The State must engage in a comprehensive assessment of its role and responsibility in responding to national and local disaster crises. Coupled with the financial constraints of the national budget, the State's irresponsibility and lack of good governance have created inefficient and inadequate environmental and disaster management policies. To date, Haiti's national disaster management plan is non-functional and virtually non-existent (Eichler, 2006:7). In addition, the government's role is merely limited to declaring a state of emergency and soliciting international assistance and services after a natural hazard occurrence. With only 2.1 percent of the total governmental budget (Roc, 2008:3), the Haitian Ministry of the Environment cannot sufficiently invest in proper, adequate assessments to tackle environmental degradation and disasters in the country.

Strong economic and political institutions are indispensable in promoting and maintaining economic development. It is also essential in securing stability and security during relief efforts. For example, Patricia Fagen (2006) described how Haiti's unstable political environment—before and after Hurricane Jeanne—interfered with relief distribution and reconstruction efforts in 2008. The author noted that relief agencies and humanitarian organizations relied on the United Nations Stabilization

[20] Haiti was tied for 168th place along with Burundi, Equatorial Guinea, Guinea, Iran, and Turkmenistan.

Mission in Haiti (MINUSTAH) to secure relief deliveries and to prevent looting once aid was made available. The Associated Press (2004) reported that MINUSTAH troops shot into the air in order to stop residents from taking food from aid vehicles. In addition, a doctor was reported treating 30 people for gunshot wounds received in fights over food (BBC, 2004). Today, MINUSTAH's presence is still established and prevalent in Haiti.

Figure 16: UN Vehicle in Haiti
Source: Photo by Crystal Andrea Felima (2010).

Haiti's overall governance and political authority lacks vision, direction, and accountability. As a result, the State has been limited in providing and securing services for its population. Haiti's political trajectory is cloudy and the country's economic potential is uncertain. A country's governing capacity influences its socio-economic development. Therefore, Haiti's economic and political development rest upon an interwoven, common agenda that pursues stability and progress.

As stated in the second chapter, Haiti has a low GDP (1.3 percent), which has declined since 1980. Verner and Egset (2007) have noted that the Haitian government's revenues amounted to only 9 percent of Haiti's GDP in 2005, compared to an average 18 percent in low-income countries and 32 percent in high-income countries (p. 46). In addition, a mere 1.8 percent of revenues derive from taxes on income, profits, or capital. The authors concluded that Haiti's weak revenue base, unstable external flows, and poor expenditure have left spending on development below the average of low-income nations. The government's inability to adequately invest in the country's development has left Haiti and its people in extreme marginality, economic insecurity, and with a high level of vulnerability and disaster risk.

3.1.2. *Low Level of Development and Inadequate Financial Resources*

Classified as a medium human development country and the only least developed nation in the Americas, Haiti is ranked 149th (out of 182 countries) on the 2009 Human Development Index (HDI) (UNDP, 2009).[21] The issue of development within the country is a critical element in disaster management. Asserted by Cardona (2004), "vulnerability signifies a lack or a deficiency of development" (p. 49). Haiti's low level of resiliency and livelihood retards the country's existing low level of development after an environmental disaster. Therefore, the promotion of development is essential in securing a healthier and balanced Haiti. In comparison to other regions, Haiti's low level of development is alarming (Table 7).

The topic of development is meant to address these questions: *How are population needs being met? Is sustainable development offered?* The United Nations Brundtland Report (1987) defined sustainable development as development which

[21] Ranking is based on data from 2007, and is published in the United Nation's Human Development Report 2009. The HDI categories, based on values, are: Low HDI (0.000 to 0.499), Medium HDI (0.500 to 0.799), High HDI (0.800 to 0.899), Very High HDI (0.900 to 1.000).

Table 7: Human Development Index 2007 and Selected Components- A Comparison of Haiti and Other Regions

	HDI Value 2007	Life Expectancy (years) 2007	Adult Literacy Rate	Combined Gross Enrollment ratio in Education (%) 2007	GDP Per Capita (PPP US$) 2007
Africa	0.547	53.9	63.3	55.9	2,729
Sub-Saharan Africa	0.514	51.5	62.9	53.5	2,031
Asia	0.724	68.8	82.1	64.5	5,837
Europe	0.902	74.9	99.2	88.2	24,775
Latin America and the Caribbean	0.821	73.4	91.2	83.4	10,077
HAITI	**0.532**	**61**	**62.1**	**52.1**	**1,155**
North America	0.952	79.2	96.5	..	..
Oceania	0.900	76.4	93.0	..	..
OECD	0.932	79.0	..	89.1	32,647
Very high human development	0.955	80.1	..	92.5	37,272
High human development	0.833	72.4	94.1	82.4	12,569
Medium human development	0.686	66.9	80.0	63.3	3,963
Low human development	0.423	51.0	47.7	47.6	862
World	0.753	67.5	83.9	67.5	9,972

Source: Created by Crystal Andrea Felima with data from the United Nations Human Development Report 2009.

"meets the needs of the present without compromising the ability of future generations to meet their own needs." Therefore, development translates to the ability for current and future populations to maintain and secure adequate resources in order to survive

comfortably. As Cardona (2004) has noted, "the reduction of vulnerability is closely linked to the provision of basic needs" (p. 48). Building on the existing understanding outlined in the Universal Declaration of Human Rights[22]—adopted and proclaimed on December 10, 1948 by the General Assembly of the United Nations—every individual has a *right* to the pursuit of happiness and dignity. In Jack Donnelly's *Universal Human Rights* (2003), the author noted: "We have human rights not to the requisites for health but to those things needed for a life of [sic] worthy of a human being" (p. 14). By recognizing human rights, one is acknowledging that the *fundamental* right for all humans, which is the right to acquire and maintain basic needs and resources (i.e., development) to live in a state of happiness.

Social indicators of the Haitian population offer a harsh reality of the nation's current level of development. To begin, Haiti's poor health and nutritional status is staggering. The FRD (2006) characterized half of the Haitian population as 'food insecure', and half of all Haitian children as undersized due to malnutrition. Reported by the WFP (2010), the 2005-2006 Demographic Health Survey (DHS) (2005-2006) concluded that 22 percent of newborn babies are born underweight; and 50 percent of pregnant women and 66 percent of children (under 5) are affected by anemia. In addition, national surveys reported that 72 percent of children aged 6 to 12 years old in rural areas suffer from iodine deficiency and 32 percent of school-age children are infected by intestinal parasites. To conclude, the WFP noted that almost 30,000 babies in Haiti suffer from mental deficiencies due their mothers' iodine deficiency during pregnancy.

[22] The declaration includes a list of rights including—but not limited to—the right to nondiscrimination, life, liberty, equal protection of the law, privacy, health, asylum, property, marry and found a family, presumption of innocence, work (just and favorable condition), social security, education, participation in cultural life, self-determination, and security of persons; the protection against arbitrary arrest, detention, and exile; and the freedom of thought, opinion, religion, assembly, and association. (Donnelly, 2003: 24).

According to a 2007 survey conducted by the Coordination Nationale de la Sécurité Alimentaire (CNSA) and the WFP, rural, food-insecure households utilized various survival strategies such as buying food on credit and borrowing (accounting for 20.5 percent of all such strategies), looking for work in the country and abroad (12.6 percent), selling livestock (10.4 percent), reducing food intake and/or expenditures (14.4 percent), and selling or mortgaging land (8.6 percent). Rural areas continuously are disadvantaged, having little to no access to health care facilities, making residents susceptible to treatable illnesses and diseases. Additionally, there are 25 physicians and 11 nurses per 100,000 people in Haiti (FRD, 2006). This is critical after an environmental hazard: medical personnel and doctors may be affected after a natural hazard occurring; therefore, receiving medical attention may be difficult.

Haiti's marginalized population represents an extreme polarization between the rich and poor. Masses of poor residents live in either rural or crowded urban areas, while the tiny population of the rich elite live in secured suburban areas. Impoverished residents who live in vulnerable areas may find it difficult to access basic amenities and infrastructures especially after a natural hazard occurrence. There may also be little access to food and shelters, hospitals or medicines, along with poor to nonexistent sanitation and sewage disposal. Importantly, clean water may not be available. Noted by Hillstrom and Hillstrom (2004), the World Health Organization (WHO) reports that Haiti has only 46 percent total water supply coverage, with 28 percent total sanitation coverage (p. 133). Wisner, et al. (2004) have noted that residents living in very closely built homes often incur greater risks from environmental hazards, which can disturb natural land drainage patterns and watercourses in cases of flooding (p. 71).

Haiti's inadequate social welfare infrastructure provides inadequate resources such as basic human services and health care. Noted by Egset and Kuttner (2007),

Haiti's weak administrative and political governance is coupled with the country's minimal basic infrastructure services. The government offers limited basic public services and public spending on the social sectors is nominal (p. 50). Much of the population lives, chronically or periodically, without electricity, running water, sewage and sanitation systems, medical care, and/or schooling. According to the FRD (2006), deficient sanitation systems, poor nutrition, and inadequate health services have pushed the country to the bottom of the World Bank's ranking of health indicators. Haiti's urban sanitation collection rate is at 30 percent and the percentage disposed of in sanitary, secure, or other landfills is 20 percent (Hillstrom and Hillstrom, 2004:30). Only ten percent of the population has electrical service, which only works 2-3 hours a day. The country has a total of 2,585 miles (4,160 kilometers) of roadways, with only 628 miles (1,011 kilometers) paved and 1,957 miles (3,149 kilometers) unpaved. However, only five percent of Haiti's roads are in good condition (Buss 11).

Additionally, Haiti ranks last in the western hemisphere in terms of health care spending: per capita, the government spends roughly US $83 annually on health care (FRD: 2006), roughly 1.26 billion gourdes in 2006 (Egset and Kutter, 2007). Noted by Buss and Gardner (2008), only 28 percent of the population has access to health care, and only 3 percent have health insurance. In addition, NGOs account for an estimated 70 percent of health-care services offered in rural areas, and NGOs deliver four-fifths of public services in the country (Esget and Kuttner, 2007: 53; Buss and Gardner, 2008: 12). Consequently, Haiti's social welfare systems and road networks are inadequate in addressing large-scale disaster evacuations and emergency response (Eichler, 2006: 7).

3.1.3. *Population Growth and Density*

Haiti's is a representation of Thomas Robert Malthus' "quasi-prophecy", highlighted in his 1798 *Essay on the Principle of Population*. His essay has become a way of explaining widespread poverty, underdevelopment, famine, disease, and environmental degradation resulting from human population pressures. Haiti's population growth exceeds the country's economic ability and level of social development. Therefore, population growth and density are important factors in understanding disaster risk.

As Rosenfeld, et al. (2005) have noted, population size and growth explains environmental hazards' apparent discrimination on disadvantaged, challenged societies. Currently, Haiti's population growth rate is 1.85 percent (CIA, 2009b), down from its previous rate of 2.3 percent in 1996 (Pregg, 1996:27). On average, women have 3.81 children. While the population growth rate has declined, the country has one of the highest population growth rates in the Americas (Diamond, 2005:330). In addition, the country has an average population density of 300 people per square kilometer. "Populations of low and medium development countries are increasing at a faster rate than the populations of high development countries" (Rosenfeld, et al., 2005:135); therefore, various socio-economic challenges within societies will generally follow.

Haiti's population growth causes rapid urbanization and unplanned development, especially in geographically vulnerable areas. Noted by Smucker, Bannister, et al., (2007), Haiti's urban population is 40 percent. Of this figure, many residents live in the shantytowns of Cité Soleil in Port-au-Prince, Raboteau in Gonaïves, and La Faucette in Cap-Haïtien. The country's overall rate of urbanization is 4.5 percent compared to less than 1 percent of population growth in rural areas (p. iii). Proposed by Catanese (1999), centralization of power and migration to the

nation's capital have caused population pressures and environmental degradation. Today, Port-au-Prince metropolitan area, growing 5 percent annually, comprises one-fourth of Haiti's entire population. Noted by Wisner, et al., (2004), rapid urbanization causes new arrivals to occupy unsafe land, construct and live in insecure and overcrowded homes, and/or work in dangerous environments (p. 70). Significantly, Smucker, Bannister, et al. (2007) have stated that "the high rate of population growth and rapid urban expansion [in Haiti] do not allow aquifers and floodplains [specifically located in the major plains of Cul-de-Sac, Gonaïves, Léogane, Les Cayes, and Cap-Haïtien] to function as natural storage and filters particularly during flood conditions" (p. iii). If a watershed is urbanized by 50 percent, the frequency of flood events could increase from once in every 100 years to once every 5 years (Abramovitz, 2001: 24).

Figure 17: Housing in Cap-Haïtien
Source: Photo by Crystal Andrea Felima (2010).

In addition, Haiti's agricultural base is also pressured by and unable to support the country's growing population. National food production covers 43 percent of the population's food requirements; 52 percent of domestic food needs is covered by commercial imports, and 6 percent covered by food aid. Reported by the WPF (2010), the United States Department of Agriculture (USDA) estimates that Haiti's yearly requirements for rice are 360,000 metric tons—with more than 80 percent currently covered by imports.

3.1.4. *Environmental Degradation and Deforestation*

Environmental degradation—a global issue—is a hazard in itself. Quoted by Buss and Gardner (2008): "Haiti ranks low on every aspect of environmental quality: stress on environment, human vulnerability, social and institutional capacity global stewardship, and environmental systems" (p. 13). Phillip N. Howard (1998) has discussed Haiti's environmental scarcity, defining the concept as "…the result of the degradation and depletion of renewable resources, the increased consumption of these resources, and their inequitable distribution" (p. 13). Environmental scarcities reveal the polarization between the rich and the poor, the underlying issues of development, and the strengths and weaknesses of Haiti's social and economic systems (Howard). The sources of environmental degradation are the destructive usage of public and private lands, the uncertainty of land titles, continuous cropping and poor agricultural practices, supply and demand of fuelwood, racial and class tensions, urbanization, population growth and density, landscape, and (rural) poverty (Catanese, 1999:25).

Haiti represents one of the worst case scenarios of the process of deforestation—a vicious cycle of poverty and economic instability—in the Western Hemisphere with only 2 percent of its original vegetation remaining. This is due to widespread logging from residents, excessive wood harvesting by private companies, and public mismanagement of natural resources (Buss and Gardner, 2008:13).

Deforestation, directly tied to the economic bundle of the Haitian population, is the process of clearing forestland into non-forested sites, which creates a variety of biodiversity, environmental, and social issues including climate change, soil erosion, flooding, and even the loss of life. Human loss results from the interactions between denuded lands (specifically hills and mountains) and rainwater. Topsoil loses its friction with the subsoil, allowing rainwater to wash down dirt, silt, gravel, and boulders, which inundate cities and towns and devastate infrastructures.

Haiti meets 72 percent of its population energy needs from local resources (firewood and charcoal at 66 percent, bagasse at 4 percent and hydro-energy at 2 percent). Noted by Haiti's Ministry for Public Works, Transportation and Communications (MPWTC) (2004), electricity consumption represents only 4 percent of the country's total final energy. Of this figure, the industry sector represents the majority of electricity consumption at 43 percent. Less than 30 percent of households are connected to the grid, and only 10 percent (158,148 households) are regularly connected with meters. However, two-thirds (285,852) of them are illegally connected. In addition, 57 percent of all electricity consumed represents non-technical, commercial losses[23]. Electrite d'Haiti (EDH), the national electricity company, is unable to provide sufficient power for the country's needs due to the illegal connections. As a result, EDH has lost millions of dollars, and the country receives only a couple of hours of electricity per day. As an alternative to EDH, various strategies are utilized: large companies and industries produce their own electricity, some families buy and use generators, and a large majority of the population use fuel wood and charcoal. Consequently, Haiti's natural environment has suffered tremendously from the demand of wood for energy and fuel.

[23] This information is based on 2002 data.

According to Marc Portnoff (2007), Haitian rural communities rely on firewood (primarily deadwood and small branches) rather than charcoal for cooking fuel, which does not represent danger nor risk to tree cover. Residents in urban areas are the primary users of charcoal. In fact, 80 percent of charcoal is consumed in the Port-au-Prince metropolitan area (p. 101). The over demand of charcoal and the mismanagement of wood threatens Haiti's environment and increases the country's level of vulnerability.

Figure 18: Charcoal in Haiti
Source: Photo by Crystal Andrea Felima (2010).

The effects of human activity on the environment have caused much degradation within the country, exacerbating the vulnerabilities of the Haitian population. Roger Michel, quoted by Nancy Roc (2008), stated that "the greatest attack on the balance in the ecosystem happened under the American occupation from 1915 to 1934 under the policy of concentrating landownership which disregarded the land-holders who were either evicted or became hired farm workers" (p. 2). In

addition, Roc (2008) noted that deforestation in Haiti accelerated during the embargo imposed by the United Nations from 1991 to 1994. Kerosene and petroleum were affected by the economic blockade; therefore, the population resorted to cutting trees for fuel and energy. Pregg (1996) reported that tree cutting occurs at a rate of 15 to 20 million trees per year, with an annual loss of at least 6,000 hectares of farmland to soil erosion (p. 35).

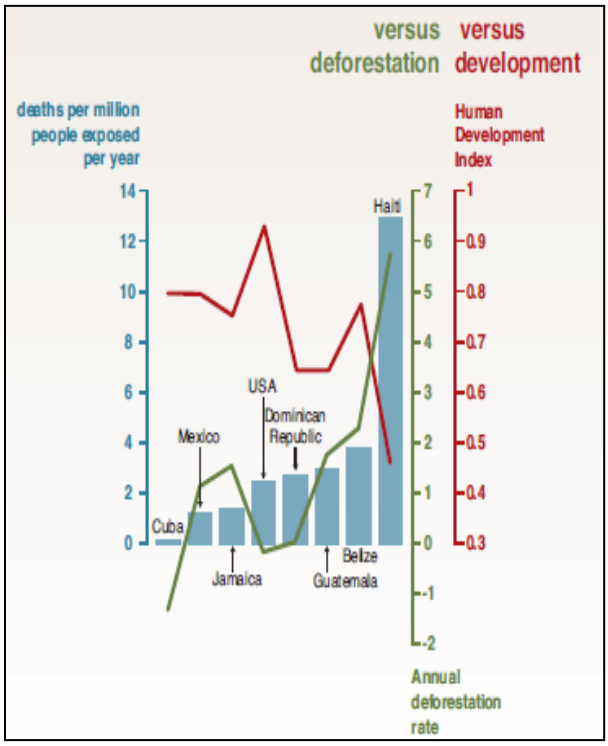


Figure 19: The Correlation between Deforestation and Development
Picture Modified, Courtesy of Preview UNEP/GRID-Europe, 2002; CRED 2004; FAO 2000; UNDP 2001. Cartography.

Haiti was forested at nearly 60 percent in 1923 and 21 percent in 1945. Today, forests cover less than 2 percent of the land. The country currently supports only seven substantial areas of forest. While two are protected national parks—Parc National Pic Macaya (55 km^2) and Parc National La Visite (20 km^2)—these forests are still subjected to illegal logging due to the lack of support, resources, and funding for

protection and preservation efforts. Noted by Howard (1998), forest projects and services were suspended after the 1991 military coup. Due to political violence and instability, these national parks were subjected to widespread logging and in-migration so much that a private individual provided funds to hire guards—about US $50 each per month—to protect La Visite Park (p. 37). Conclusively, the loss of forestation and topsoil contributes to disaster risk in Haiti. Eichler (2008) noted that research studies reveal an 89 percent correlation between the extent of deforestation and incidence of victims in cases of environmental hazards such as tropical storms, flooding, and mudslides.

3.1.5. *Disaster Risk Factors in Context*

The shift in focus from natural hazards to underlying vulnerabilities has provided a richer understanding of the socio-economic and political factors that significantly contribute to the high level of disaster risk for Haiti and its population. Undeniably, there is a strong causal relationship between poverty, development, governance, and a degraded environment, which in turn creates disaster risk.

Factors such as a low level of livelihood, poor governance and political instability, inadequate levels and lack of access to healthcare, unplanned urbanization, and poor infrastructures compromise a community's capacity to increase its development and its ability to respond and recover from a natural hazard event. These factors underline the realities of *and* possibilities for the vulnerable population. Haitians struggle with issues on a daily basis, constraining their ability to cope with stress factors.

In order to alleviate stress factors and lessen disaster risk, effective development measures and policies must be immediately pursued and promoted. As stated within this thesis, development and disasters have been usually polarized and frequently situated as mutually exclusive concepts. By contrast, this analysis reveals

that these two topics are highly interconnected and correlated. To reiterate, Haiti must pursue development in the form of good governance, poverty eradication, environmental and disaster management, international assistance, and community involvement. These recommendations are proposed to break the cycle of environmental disasters of the past.

3.2. SOLUTIONS AND RECOMMENDATIONS

As proposed, four solutions are recommended in order to mitigate the impacts of future environmental crises and to promote development for the Haitian people. Haiti has a critical opportunity to alleviate economic hardships and correct political and governance faults. While Haiti is presented with challenges for reformation, actions plans can be created, initiated, and pursued with practical and attainable goals, investment and financial support, and unified participation from internal and external actors. To address the casual factors of environmental disasters, specific recommendations and strategies are proposed in order to encourage the protection of life and livelihoods, to promote development and disaster management, and to enhance Haiti's socio-economic and political institutions.

3.2.1. *Governmental Responsibility and Poverty Eradication*

Noted by Cannon (1994), a society's political and economic processes serve as a useful way in understanding how the economic system and class structure distribute income and access to resources to populations, while influencing vulnerability and disaster risk (p. 18). Therefore, the major actor in development and disaster management remains the State. Through its various organs and branches, the Haitian government should assume the responsibility of alleviating poverty, promoting development, and responding to environmental and disaster crises. Essentially, the Haitian government must consider how their (lack of) decisions and "vision" influence population vulnerability to natural hazards. The impacts of hydro-geologic hazards

(i.e., flooding and hurricanes) can be minimized with policies directed at avoidance, mitigation, and prevention. While being virtually absent from managing disasters, the government can redirect its attention and focus on reconstruction and rebuilding the country in order to shape development and vulnerability. The first step toward change is to re-examine the nation's objectives and prioritize development initiatives.

Sustainable development depends on the balance between socio-economic, political, and environmental objectives. Throughout history, continued political instability and weak governance in Haiti has hampered and undermined development initiatives, creating humanitarian challenges and obstacles for the local populations. As noted before, poverty in Haiti is alarming. Catanese (1999) has suggested that political and economic goals should be pursued simultaneously and not sequentially: "The deepest roots of Haiti's political problems lie in social inequality and economic misdistribution. The political sphere will follow if these important issues are addressed" (p. 77). To tackle these issues, the author proposed that "…domestic leaders in Haiti and major international donors should initiate discussions on the exact roles of central and regional governments in alleviating rural poverty, increasing real per capita incomes, and reducing income inequality" (p. 82).

In order to promote Haiti's economy and to support the population's livelihoods, investment in education and the agricultural sector should be pursued. As mentioned, education and employment are essential in poverty reduction in Haiti. The educational sector is highly under-financed. Noted by Egset and Kuttner (2007), Haiti's public domestic financing on education in 2006 amounted to 1.7 percent of the nation's GDP in 2006[24]—the lowest in the Latin American and Caribbean region, where the average is 5 percent. (p. 50). In cooperation with national and international

[24] If donor financing is included in this figure, financing for education increases to 2.1 percent of Haiti's GDP.

actors, Haiti should move towards priority areas by improving and supporting education. Some suggestions for education reform are:

1. Increase student enrollment in primary and secondary schools, especially in rural areas
2. Improve the quality of education through teacher training and support
3. Improve educational access, specifically within rural areas
4. Communicate specific educational needs to the international community (e.g., soliciting donations for a student's tuition, uniforms, and books)

In addition to improving the educational sector—agriculture must also be supported. The agricultural sector has been adversely affected over the past decades. Comparatively, during the 1950s, agriculture represented 90 percent of the labor force and 50 percent of the nation's GDP (Malik, 2001:388). However, as mentioned, the agricultural sector currently contributes to approximately two-thirds of the labor force, and one-quarter of Haiti's GDP. The nation's agricultural productivity has declined due to poor farming practices, rural migration, population pressure, insecure land tenure system, deforestation, natural hazards, and international competition. Therefore, Haiti's agricultural sector must be restored with proper investment. Haitians farmers need financial support to buy seeds, fertilizers, and farm tools, among other essentials. In addition, farmers need better knowledge and training in order to improve agricultural practices to stop soil degradation. With the support and commitment of the government, these strategies can be pursued.

The potential of human development and economic growth is contingent on political stability and strong governance in Haiti. Therefore, the country's economic institutions and policies contribute to both environmental degradation and population vulnerability to hazards, and these issues must be addressed accordingly. Measures to

reduce poverty and to promote strong governance are critical in order to tackle the causal link between development, disaster risks, and environmental degradation.

In sum, the role of governance is critical in reversing environmental degradation and reducing disaster risk and vulnerability. Good governance in Haiti will lie in legislation and policies that are inclusive, appropriate, and effective. To avoid competing self-interests, the national framework, platforms, and government organization must be strengthened. The State must ensure that development and disaster mitigation is a national and local priority with a strong governmental basis for implementation. It is the government that should initiate engagement among all actors to consider the interests and needs of the people.

Achieving development and environmental stability is not an easy task. It takes political will, determination, and concrete *vision*. The trajectory of the possibilities and hope for Haiti is attainable; however, the State cannot remain silent and stagnant regarding issues concerning the Haitian people. In the popular imagination, Haiti's vision is perceived as cloudy and uncertain due to the longstanding history of weak institutional capacity, poor governance, and political instability. Consequently, the government is viewed as corrupt, dishonest, and self-indulgent. The result of this lack of vision is a fragmented, blurry picture of Haiti's future. The government responsibility (or lack it) must be challenged since relying on soliciting foreign aid has not proven effective for Haitian development.

3.2.2. *Environmental and Disaster Management*

Disaster and environmental management, combined with ecosystem services, can offer promising opportunities aimed to reduce disaster risk, decrease poverty, and achieve sustainable development for vulnerable populations. Forest ecosystems play a critical role in reducing the vulnerability of populations to environmental disasters,

both in terms of minimizing communities' exposure to natural hazards and promoting secure livelihood resources to withstand and recover from disasters.

Environmental management must incorporate an inclusive partnership, recognizing the vital role of a variety of actors. In order to tackle the underlying risk factors and to promote a higher coping capacity, environmental and natural resource management must be pursued. Built on Eichler's (2006) four recommendations, these efforts include watershed management, improving agricultural practices, investment in alternative energy sources, and the implementation and improvement of reforestation efforts.

Haiti must pursue **watershed management** (e.g., flood protection, water storage systems, and drainage systems). This offers the best approach to handle water quality issues. Noted by Buss and Gardner (2008), 25 of Haiti's 30 major watersheds are now devoid of natural forest cover (p. 13). Watershed degradation is created by soil erosion, caused by poor and inappropriate agricultural practices. This reduces farms' product potential, adversely impacts bio-diversity, and contributes to flooding and devastating downstream consequences. Therefore, watershed management serves as a means to manage water supply, improve water quality, provide soil erosion control, enhance recreation activities, manage animal waste, and balance irrigation systems. For Haiti, this strategy will help mitigate flood destruction of shelter and crops, control soil erosion, and ensure the availability of safe drinking water.

Another strategy Haiti can consider is **improving agricultural practices** in order to deliver healthy and high quality food, while ensuring livelihoods and enhancing the environment. Better and new practices will maintain soil fertility, reduce landslide risk and loss of crops, and promote agricultural productivity. Over-cultivation and overgrazing are serious issues that exhaust soil and removes vegetation that prevents soil erosion, respectively. Haiti's agricultural sector supports 80 percent

of its population, and food crops represent 80 percent of all products cultivated. Swartley and Toussaint (2006) have stated that the production and cultivation of these crops have environmental devastating impacts because these crops are mostly produced without any soil conversation practices. This causes severe erosion, a decrease in product yield, and forces Haitians peasants to clear new plots, burn vegetation, and begin a new cycle of production (p. 10).

Howard (1998) has suggested that Haitian farmers should return to tree crops, (e.g., coffee, cocoa, and fruit trees) in order to protect slopes from the process of soil erosion. Until the early 1970s, farmers produced tree crops for centuries. However, rising export tariffs and high import duties hindered production and discouraged small producers to export (p. 39).

Figure 20: Cocoa Tree in Lende, Haiti.
Source: Photo by Crystal Andrea Felima (2010).

In addition to tree crops, Howard (1998) suggested that the Vetiver grass (native to India) should be utilized since it is an practical, cost-efficient plant and it

provides an array of benefits: protects soil around tree crops, stabilizes hedges, protects infrastructure (e.g., drains, canals, road systems), conserves water and soil moisture, provides slope protection and flood control, and prevents and reduces soil erosion. Vetiver is an ideal, effective plant for Haiti's warm climate. The plant is resistant to drought, recovers quickly when walked upon, and requires low maintenance. Vetiver produces valuable oil. In fact, Haiti is one of the world's leading producers of Vetiver oil—a valuable product cultivated for the aromatic essential oil. Therefore, this plant is widely known and available in the country.

Figure 21: Vetiver plant in Milot, Haiti
Source: Photo by Crystal Andrea Felima (2010).

Dick Grimshaw (2010), Chairman and Founder of The Vetiver Network International (TVNI), proposed that Haiti can move towards reversing environmental degradation by using the Vetiver plant with a 15-20 year plan and a US $120 million per year investment for 100 percent protection of the country. Through personal communication, Grimshaw explained that this figure is a rough estimate. The

investment would be much lower if Haiti's most fragile, degraded areas receive the protection first. Once Haitian farmers are able to maintain the Vetiver plant, the cost to sustain the plant would also reduce. The TVNI has communicated Vetiver's benefits to the World Bank and other donors (personal communication, April 7, 2010).

There has been subsequent communication to the Haitian government about the Vetiver plant. Noted by Dr. Criss Juliard (2010), the Prime Minister, the Minister of Agriculture, and the USAID were opposed to using the Vetiver plant on a large scale in Haiti. The government and USAID feared that people would dig up the planted Vetiver and sell the plant into Haiti's Vetiver oil industry. After many years of prodding by Vetiver supporters, the Haitian Government and USAID allowed a major Vetiver initiative in Haiti: the WINNER (Watershed Initiative for National Natural Environment Resources) project. The WINNER project officially launched October 8, 2009 in the presence of the Haitian President René Préval, Ambassador to Haiti Kenneth Merten, and more than 500 participants[25].

To conclude, the Vetiver plant offers more benefits than the often-recommended Leucaena plant. Juliard (2010) stated that it can take 10 to 20 years to establish a forest that creates a "mattress" of dead leaves, underbrush and a canopy to slow down rain drops from inundating cities. The alternative to this timeline is to utilize the Vetiver plant, which will create an environment where trees can grow faster. In addition, Juliard suggests that the *Tephrosia vogelii*, a nitrogen fixing plant, is a tree

[25] The WINNER project is investing US $100 million in watershed and plain protection in two regions—the Rivière Grise (Grande Rivière du Cul-de-Sac) and the La Branle and Bassin Mangnan in the Gonaives / La Quinte watersheds. Dr. Juliard explained that if Vetiver grows and flourishes within these two regions—especially through farmer to farmer viral communication over 4 years—the project would yield significant results. Dr. Juliard has worked with the WINNER project where he developed and delivered Vetiver training for the project's technical staff and participating partners on how to establish Vetiver systems in the upper ends of watersheds and to provide disaster mitigation in the riverbeds and plains that were flooded during each heavy rainy season (personal communication, April 7, 2010). See USAID's WINNER Quarterly Report Fourth Quarter 2009 for more information: http://pcrmedia.com/winner/en/WINNER_Quarterly_Report_001.pdf

with complementary properties to the Vetiver plant. *Tephrosia vogelii* and Vetiver, planted together, are great for regenerating impoverished and denuded soils, for capturing surface run-off to keep moisture in the hillsides and upper watersheds, and for allowing food and tree crops to be grown again on gentle hillsides. Leucaena is invasive and competes with other food crops. Therefore, Vetiver provides better soil erosion control, requires low maintenance, and produces a higher volume of biomass than Leucaena.

Another strategy to consider is **investing in alternative energy sources**. This is critical in reducing wood dependency for fuel and energy in Haiti. Most importantly, this recommendation is aimed to promote better use of the country's natural environment. El Hierro, a Spanish island located off the coast of Africa in the Atlantic Ocean, is a revolutionary model for the future. This island is the world's first nation to run on 100 percent renewable energy—specifically wind and solar energy. The MPWTC (2004) has reported that Haiti has both wind and solar energy potential; however, thorough studies and research have not been conducted in a "professional manner." Haiti has significant wind energy potential in the North, Northwest, and West regions of the country. In addition, Haiti has an estimated 5 kWh/m2/day[26] of solar radiation. Individuals who produce electricity and hot water primarily utilize solar energy. The MPWTC (2004) has indentified problems within solar energy potential such as investment and local peculiarities (e.g. food preparation customs, corrosion of the pipeline in the solar water heater, lack of maintenance capability, and stealing of photovoltaic panels at private and public installations).

As an alternative to wood for fuel and energy, the *Jatropha curcas* has been considered for the production of biodiesel fuel, primarily from NGOs, seed growers, and profit companies such as D1 Oils plc, an alternative energy crop company.

[26] kWh/m2/day = kilowatt hours per square meter per day

Biodiesel is a clean burning alternative fuel, produced from domestic, renewable resources. Portnoff (2007) has mentioned that jatropha is seen as the "poster child" by some proponents: this plants offer great potential in Haiti by "improving the livelihood of poor people in local communities generating rural employment, contributing to Haiti's reforestation, land reclamation, and easing the burden of oil imports" (p. 47). These benefits of Jatropha are invaluable. However, Jatropha does offer limitations and concerns such as toxicity of the plant and oil storage requirements. While this plant has its limitations, it should be considered in its entirety as a means to explore all options for Haiti.

Asserted by Juliard (2010), "Trees by themselves don't prevent soil erosion, but forests do." Forests provide irreplaceable ecological services. Therefore, the **implementation of effective reforestation efforts and initiatives** can offer a number of benefits in Haiti: stabilize soil and reverse soil degradation; buffer water and prevent flooding; restore habitat and promote biodiversity; improve food security and enhance natural pollinators for agricultural crops; ensure air and water quality air; protect plants and animal species, and slow global warming and mitigate extreme weather events.

The success of reforestation efforts is contingent on the availability of alternative energy sources. Reforestation initiatives have been present in Haiti since the last 40 years. However, these efforts have been halted due to political instability (e.g., political crises period of 1991-1994 and 2004). Implementation of reforestation efforts and the distribution alternative energy sources to areas should be pursued simultaneously. As noted in Chapter Two, due to reforestation initiatives in Haiti during the 1970s and 1980s, 10 million trees grew annually by 1990. However, as a result of the 1991 military coup against President Aristide, reforestation efforts were halted, while tree logging accelerated. The reversal of deforestation has not proven

effective in meeting Haiti's environmental degradation. Political instability and poverty have pressured and countered initiatives, making reforestation virtually unsuccessful. Therefore, in order for investment in reforestation efforts to be effective, alternative energy sources must be supplied and political and socio-economic challenges must be effectively tackled.

Damage to the environment has posed immediate risk factors to property and human lives. Therefore, the goal of environmental management is to fully develop and implement strategies on a national level. These strategies can provide a proactive approach as a means to address environmental concerns, to promote resiliency, and to encourage development in Haiti. In addition, these initiatives can empower communities to become actively involved in issues regarding their livelihoods.

In order to "manage" the risks, vulnerabilities, and the consequences of environmental disasters, environmental management must be coupled with disaster management strategies. Disaster management includes a range of strategies and efforts aimed to respond the impacts of natural hazards—pre- and post-disaster. Within disaster management, there is hazard mitigation, which includes "all those actions taken before, during, and after the occurrence of a natural hazard that minimize its impacts" (Rosenfeld, et al., 2005:148). Strategies include the mobilization of communication services, the construction of dams, building codes, land-use policies, rehabilitation services, and the creation of early warning systems. Disaster management also includes preparedness plans such as the coordination of evacuation, the organization of search and rescue operations, and provision of relief to survivors. It is important for Haiti to pursue disaster management to minimize losses to its citizens and to prevent disruption to the fabric of its society.

A wide-scale early warning system (e.g., TV/radio messages and sirens) is essential to alert seismic activity and to forecast upcoming storms to residents.

Prevention and early warning methods can offer residents information concerning proper preparedness actions and evacuation plans in the area. Plans can substantially reduce the impacts of hazards if people are well-informed and are provided the tools and information about prevention and evacuation. However, in order for an early warning system to serve as a sufficient tool in Haiti, it must be properly considered within a socio-economic context. There must be adequate resources (e.g., buses, food, and shelter) and a sound evacuation plan to save lives and to protect livelihoods. Hurricane Katrina presents a prime example of how a mandatory evacuation in New Orleans was ineffective. While the mayor issued a mandatory evacuation, many low-income residents did not have transportation, housing accommodations, and resources to safely leave the area before the city flooded. Therefore, in order to fully prepare and support residents during all phases of a disaster, proper evacuations strategies and effective disaster management must be adequately implemented.

Disaster management also calls into the question the possibility of Haiti creating a plan comparable to Cuba, which has an effective system that prepares and mobilizes its residents in cases of tropical cyclones. Reported by John Cherian (2005) in *Frontline*:

> *Cuba was hit by a Category Five hurricane in September 2004. The hurricane generated winds at the speed of 250 km/hour. More than 1.5 million Cubans were evacuated from their homes in Havana and surrounding areas immediately after the hurricane warning was given. There was not a single casualty, though 20,000 houses were damaged. Cuba, though a developing country facing tremendous economic problems, has a tried and tested disaster management policy. The Cuban leadership, including President Fidel Castro, go on television and radio days in advance to warn the people to evacuate to higher ground. (It took U.S. President George W. Bush four days after Hurricane Katrina struck to make a public appearance on the national media network.) Since 1995, more than a dozen Category Five hurricanes have hit the island. The damage to life and property has been minimal.*

Cuba's system reflects a joint effort between the government, meteorologists, the National Defense Council, the media, public administrators, and the community. It is evident that Cuba's main priority is saving and protecting lives. Cuba has a four-phase system: (1) informs residents two days prior to a natural event; (2) issues warnings of potential dangers the next day; (3) alerts residents hours before a natural hazard; and (4) immediately responds after a hazard with public transportation to evacuate residents from affected area (Sims and Vogelman, 2002). Cuba's disaster management is a reflection of the country's socialist government, political structure, and minimal political divisions, which allows for effective disaster warning and response. The effectiveness of Cuba's strategies can be integrated into a plan that is practical for Haiti. With the focus of protecting and saving lives, Haiti can move toward increasing its control over managing risks and vulnerability.

Environmental and disaster assessment must be utilized in order to collect data of natural hazard-related risks (from floods, landslides, and seismic activity), and disaster-prone areas. Satellite imagery and geographic information system (GIS) mapping should be employed throughout Haiti to provide post-disaster data and assessments. Through technology, scientists can identify multi-hazard areas, provide adequate assessments of vulnerability, develop disaster risk maps, and provide risk reduction strategies and preparedness plans. In addition, environmental authorities should utilize spatial planning (i.e., land use planning) to influence the distribution of people and activities in appropriate areas. This will allow the State and disaster/environmental managers and authorities to identify vulnerability and implement projects within high-risk populations. This range of environmental and disaster initiatives is an urgent priority. Environmental management and disaster research in Haiti is an on-going, growing field; therefore, existing knowledge can be

made available to individuals as a means to provide public awareness, advocacy, and analyses of hazard-prone areas.

To conclude, Haiti is a multi-vulnerable nation. Thus, there is a need for a multi-pronged approach to disaster and development. It is of utmost importance to promote the involvement of all actors in disaster management and development initiatives in order to promote the awareness of underlying risks conditions and multiple vulnerabilities of the population. To address risk factors that adversely affect development and the environment, the governance system must be strengthened and held accountable, development must be pursued, and awareness and capacity building systems must be appropriate and implemented.

3.2.3. *International Assistance and Restructuring of Aid*

In Haiti, the international community is the first group to arrive at a disaster site with professional relief workers, resources, and aid. These relief organizations not only provide immediate needs to assist with recovery, but they also compile data in order to assess damages losses, and populations. In addition to disaster relief, the international community has provided many services through private educational institutions, public medical clinics, and faith-based orphanages. Due to the international community's large presence in Haiti, it is imperative that this influential body lobby on behalf of the Haitian people in order to promote development, better land use decision, and disaster management. These organizations can continue to play a key role through research, education, and training programs within the field of environmental conservation and disaster risk reduction.

Certainly, international support and aid can supply and offer Haitian communities with resources the government cannot provide as yet. On the other hand, international organizations provide a valuable lesson regarding "aid". While there are thousands of organizations that are providing aid in Haiti, the genuine interest in

helping Haiti has been the root of many problems with humanitarian and relief efforts today. While many international humanitarian workers, and by extension the organizations they work for, have a real commitment in assisting Haitians, the response to the various challenges in Haiti have become very professionalized, generalized, and institutionalized. Affirmed by Bellegarde-Smith (2004):

> *Strong interventionist policies from the International Monetary Fund (IMF) and the World Bank, foreign aid, and increased levels of "investment" have oftentimes resulted in improvement in the economy but the standard of living of most Haitians has continued to decrease nonetheless.* (p. 143)

Such humanitarian response has not lifted Haiti out of the ranks of being the poorest country in the western hemisphere. According to economist Nicholas Eberstadt (2006), Haiti has received $8.3 billion in foreign aid from 1969 to 2004 (Buss and Gardner, 2004:48; Dilanian, 2010). From 2005 to 2006, Haiti received an additional $1.3 billion in aid (Buss and Gardner, 2004). USA Today reported that currently Haiti is 25 percent poorer than it was in 1945 (Dilanian, 2010). It seems international organizations have excelled in developing more complex projects and methods and more effective means of soliciting donations, which have not necessarily had a positive impact on Haitian development. External and internal actors have often pursued self-interests rather than gearing their efforts towards the needs of the Haitian people. As a result, some donations have been misapplied and/or diverted to other costs rather than supporting the Haitian people in-need. These actions have created an incredible amount of distrust and doubts among individuals who want to give. Therefore, there must be accountability and responsibility among international organizations and the government in how they apply funds and resources.

Eighty percent of the Haitian government's budget relies on the financial support from the international community (Roc, 2008: 6), but without accountability. Since 1973, the United States has been Haiti's largest international donor. Between 1995 and 2003, the US contributed more than US $850 million to development projects and initiatives in Haiti. In 2004, the US also pledged an additional US $230 million in aid through 2006 (FRD, 2007:12). As Buss and Gardner (2008) have noted, international assistance provides budget support; however, aid dependency undermines institutional effectiveness and relieves the government of its responsibility to fund development projects through taxation and other government revenues (p. 98-99). Therefore, the international community must find a way to restructure aid distribution in order to reproduce its benefits.

Private organizations can learn from experiences and perfect their method of aid-relief distribution. Therefore, foreign organizations must utilize a community participatory approach in order to empower and aid communities effectively. The thousands of organizations within Haiti have not provided sustainable development due to its lack of collaboration with the Haitian people. Consequently, this has prevented Haitian communities from increasing their resources and decreasing their level of vulnerability to environmental hazards. This has presented a humanitarian dilemma in Haiti.

As stated, international response to Haiti can be characterized as being traditionally politicized, technocratic, and institutionalized. Therefore, in order to respond to local and specific community interests, the international community must invest in programs that strive to create and maintain public accountability once funding ceases. If a program needs continued support, the international community must realize that Haiti may not be able to maintain the operations due to the lack of resources, funds, and training (Buss and Gardner, 2008: 144). Therefore, this is a

crucial opportunity for the international community to tap into local participation and move away from short-term humanitarian projects that only provide "relief", not development. Essentially, these projects serve as *band-aid* initiatives; they address surface issues concerning basic needs and environmental degradation. To tackle the root causes of vulnerability in Haiti, sustainable development projects intended to provide continued benefits to the population must be pursued.

3.2.4. *Community Participation*

To complement humanitarian efforts, foreign actors must engage local participation in order to recognize the collective needs of the community. Local knowledge and practices must be considered as a component to environmental and disaster management in order to create inclusive plans and programs with the consideration of the community. Quoted by Hyland and Bennett (2005), Carl Moore (1996) defines community as:

> *…the means by which people live together. Communities enable people to protect themselves and to acquire the resources that provide for their needs. Communities provide intellectual, moral, and social values that give purpose to survival. Community members share an identity, speak a common language, agree upon role definitions, share common values, assume some permanent membership status, and understand the social boundaries within which they operate.* (p. 5)

Community participation involves a variety of values such as inclusive collaboration, active citizenship, community empowerment and engagement, self-determination, development, accountability, and capacity building. These factors will support the creation and implementation of holistic approaches that address complex, specific issues within the community. Affirmed by Delica-Willison and Willison (2004):

> *Powerlessness has been identified as one of the manifestations of a vulnerable condition. Organizing poor and vulnerable people is a direct counter-measure to powerless. The cornerstone of efforts to reduce*

> *vulnerability is self-organization of the vulnerable at the local community level. Organizing themselves is an effective antidote to powerlessness, which is a major source of vulnerability.* (p. 155)

Through local participation, populations can achieve effective services and priority planning while developing skills and building competencies within the community.

Populations in Haiti have the capacity to withstand the current challenges of low development and environmental degradation. However, it seems as if many foreign organizations and agencies have "infiltrated" the country as if Haitians need to be *saved* from their "ills". Support, training, and resources must be targeted in active communities in order to enhance development, improve efficiency, and minimize obstacles. This could prove sustainable, while building confidence and self-esteem without destroying human dignity. Communities have resources, skills, and knowledge that are untapped and generally ignored with regards to humanitarian efforts. Therefore, in order to multiply the benefits of aid, humanitarian assistance should be restructured and channeled through community institutions (e.g., churches, grassroots organizations, and schools). This will mobilize local participants and allow them to become actively engaged in reconstruction and development projects in their areas.

The purpose of community involvement is to build and organize local efforts as a means to increase participation and promote social justice. Therefore, local participation in Haiti can provide a voice to and from the community, while offering new opportunities to create innovative initiatives. It is the most vulnerable, marginalized groups that are silenced and discouraged from contributing to decision-making. Community organizing is a practical mobilization since people are brought together by a common interest and a common agenda. Aware and responsive communities can better communicate their needs to benefactors regarding available resources and training to support local projects and programs. With humanitarian support, local populations can implement specific strategies and programs that

specifically target the community needs and interests. Therefore, empowered Haitian communities can serve as agents in rebuilding their livelihoods with the proper resources, training, and funding. Through community mobilization, a social movement might be created on the basis of community needs and interests. As a result, local participation would appeal to foreign organizations and the State for support and resources.

3.3. LINKING RECOMMENDATIONS

If these strategies are to be sustainable and effective, they must be developed and implemented in a coherent, coordinated way. In addition, all efforts must aim to confront Haiti's multiple vulnerabilities that are rooted in disaster risk. With accountability of the government and local authorities, the support and commitment from the international community and, most importantly, the active participation from Haitians in the country and abroad, a horizontal partnership can be pursued. Developing this type of relationship offers a proactive approach towards reformation, rebuilding, and development in Haiti. Innovative strategies must incorporate multi-dimensional ideas that promote horizontal relationships. This will avoid vertical relationships (i.e., those that are top-down, hierarchical networks), which may cause the interests of the vulnerable to be subordinated to the self-interests of the decision makers and financial benefactors. By contrast, a horizontal relationship is more inclusive for the Haitian people; it unifies a variety of approaches, experiences, and responsibilities as a means to address all facets of development and environmental management in a practical and locally relative manner.

To utilize these recommendations effectively, actors must be willing and able to collectively communicate and actively participate in the efforts of the Haitian people. The international community is called to provide financial assistance, training, and resources for the country. Additionally, international actors are asked to resolve

Haitian debt and loan obligations; support Haiti in increasing economic participation and trade with other countries; and most importantly, assist in governance issues. Buss and Gardner (2007) have noted that if international patrons ignore governance issues, there could be inevitable aid failures; "…strategic countries like Haiti require intense engagement with good governance; political stability is the highest priority" (p. 133).

To that end, international actors should channel resources to local community leaders and grassroots organizations. This will target communities to a greater extent with the purpose of tackling issues within the country as a whole. State authorities should also facilitate and administer government resources to local organizations and institutions. In addition, the government must hold these local authorities accountable and responsible in order to prevent corruption and fraud. Lastly, the importance of local institutions, grassroots organizations, and community mobilization is critical to disaster management and development. Citizen participation could provide Haitians a sense of volunteerism, inclusiveness, and community spirit that empowers them to become agents of change.

CONCLUSION:

A Way Forward

Sak vid pa kanp.
An empty sack can't stand up.

-Haitian Proverb

Any discussion of Haitian vulnerability would be incomplete without recognizing that a natural hazard is in itself a hazard; however, the disasters associated with them are frequently human-induced. Socio-political and economic variables exacerbate Haiti's existing level of disaster risk. Therefore, it is of importance to understand the significance of development, environmental conservation, and disaster management for communities that live in hazard-prone areas in the country. Given the ever increasing toll of the disaster events in Haiti, the way forward is to build safer structures, support disaster research, enact policies based on population needs, improve agricultural practices, and encourage local participation. Response to environmental disasters must become pro-active rather than re-active to reverse and minimize the impacts of natural hazards in Haiti.

Disaster research has been informed and complemented by work regarding risk and vulnerability studies; development, resiliency, and livelihood assessment; resource management, hazard mitigation, and disaster preparedness; environmental effects and climate change; and human ecology of nature and hazards. These themes have addressed the multi-faceted components of disasters. The data and statistics presented throughout this thesis are a reflection of the multiple vulnerabilities caused by poverty, environmental degradation, and policy failures in Haiti.

It is critical to understand the link between environment and society. As previously stated, the development of a society is dependent on the development of its environment and *vice versa*. If they are mutually supported and respected, the natural environmental is protected and development is secured. Since natural hazards adversely impact developing and environmentally vulnerable countries, development and environmental protection must be recognized. The figure below illustrates the vulnerability of the Haitian people to environmental disasters.

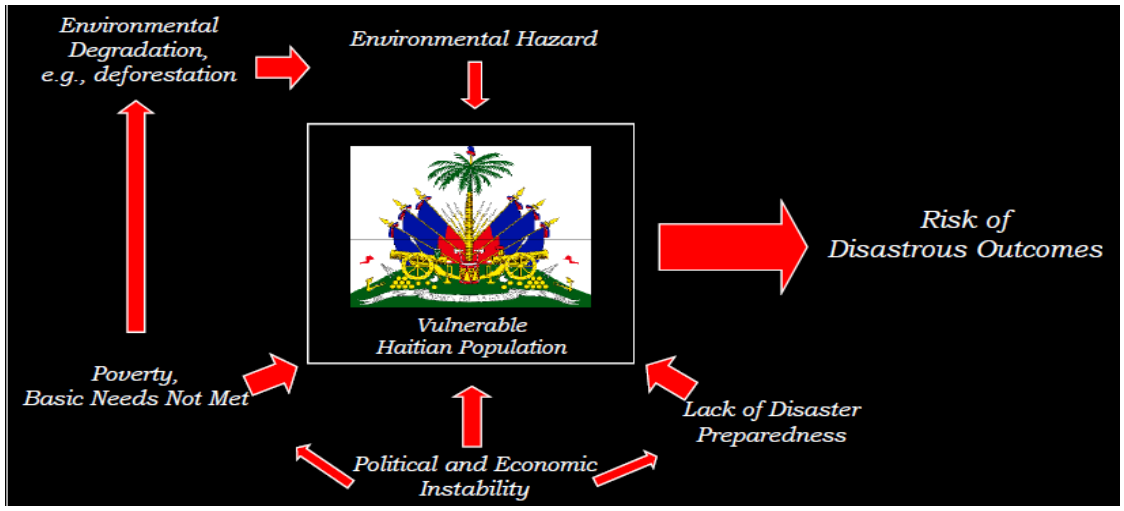


Figure 22: Haitian Vulnerability Diagram
Source: Crystal Andrea Felima (2009), Reprinted with permission.

This thesis has aimed to link environmental disasters, human activity, and development of Haiti in order to reveal the importance of sustainable development and environmental protection, which is critical in ensuring the nation's social and economic development. Rather than focus primarily on humanitarian assistance and aid, political and socio-economic development must take priority. The devastation of the 2004 and 2008 flooding events in Haiti offer an opportunity to re-assess the role of development in disaster prevention and mitigation. It also presents a chance to make

significant progress in a global commitment to environmental conservation. Rather than waiting for the next disaster to remind the world of Haitian poverty and the country's imbalanced institutions, development and disaster mitigation must become a central part in human rights and policy discussions.

POST-SCRIPT:

Personal Reflections to Haiti's January 12, 2010 Earthquake

Lespwa fè viv.
Hope makes one live.

-Haitian Proverb

On January 12, 2010, I joined Haiti and its Diaspora grieving over the tragedy that devastated my father's homeland. The endless stream of tragic images and stories flooded all media circuits, highlighting the remains of disaster victims and the pleas of desperate survivors. In the midst of writing this thesis, I aimed to address several questions regarding the issues of vulnerability and development in Haiti. This 7.0 earthquake underscored these two themes, while representing the realities of the crises of Haiti. As stated, the multiple jeopardies of Haitian vulnerability have plagued the population in the face of natural hazards. This earthquake was no exception.

Haiti is in a critical moment for rebuilding. Billions of dollars have been donated. Several strategies for reconstruction have been recommended. Therefore, Haiti is left with one question: *What's next?* As proposed in this thesis, Haiti must pursue a collaborative, inclusive effort in order to rebuild its political and economic institutions, while focusing on essential needs such as housing, healthcare, employment, food security, and education. The key actors for this proposal are the Haitian people. Their energy, knowledge, and will power must be utilized. They are the agents of change, and their efforts must be made use of to continue the change that will be needed.

I hope that sustainable solutions will be pursued to reduce poverty and to correct injustices in Haiti. In the name of humanity and human rights, we—the global

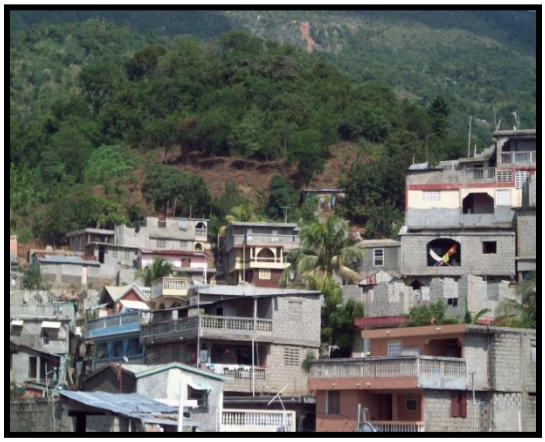
community—cannot continue to ignore the issues challenging development and livelihoods within Haiti. If we disregard Haiti's situation, we are contributing to the problem of complacency and apathy. Therefore, I leave you with one last sentence in Haitian Creole: *L'Union Fait La Force*.

APPENDIX:

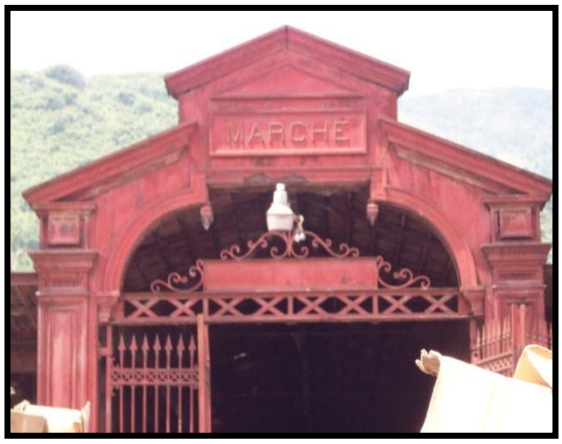
Photographs

This appendix includes selected pictures from my trip to Haiti in March 2010. Since a picture can say a thousand words, I wanted to include this addition to my thesis to provide additional understanding of the experiences, realities, and possibilities of the country and the Haitian people. Through hardships and obstacles, Haiti maintains its cultural beauty and its population's resilience.

HOUSING



THE MARKET



CHARCOAL

GARBAGE DISPOSAL

ELECTRICITY

HUMANITARIAN AND FOREIGN ORGANIZATIONS

PLANTS FOR SOIL EROSION

AGRICULTURE

LANDSCAPE AND TERRAIN

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